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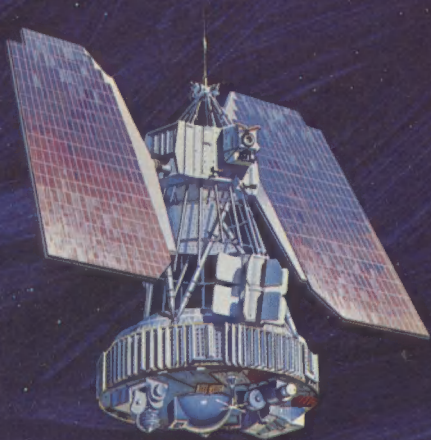
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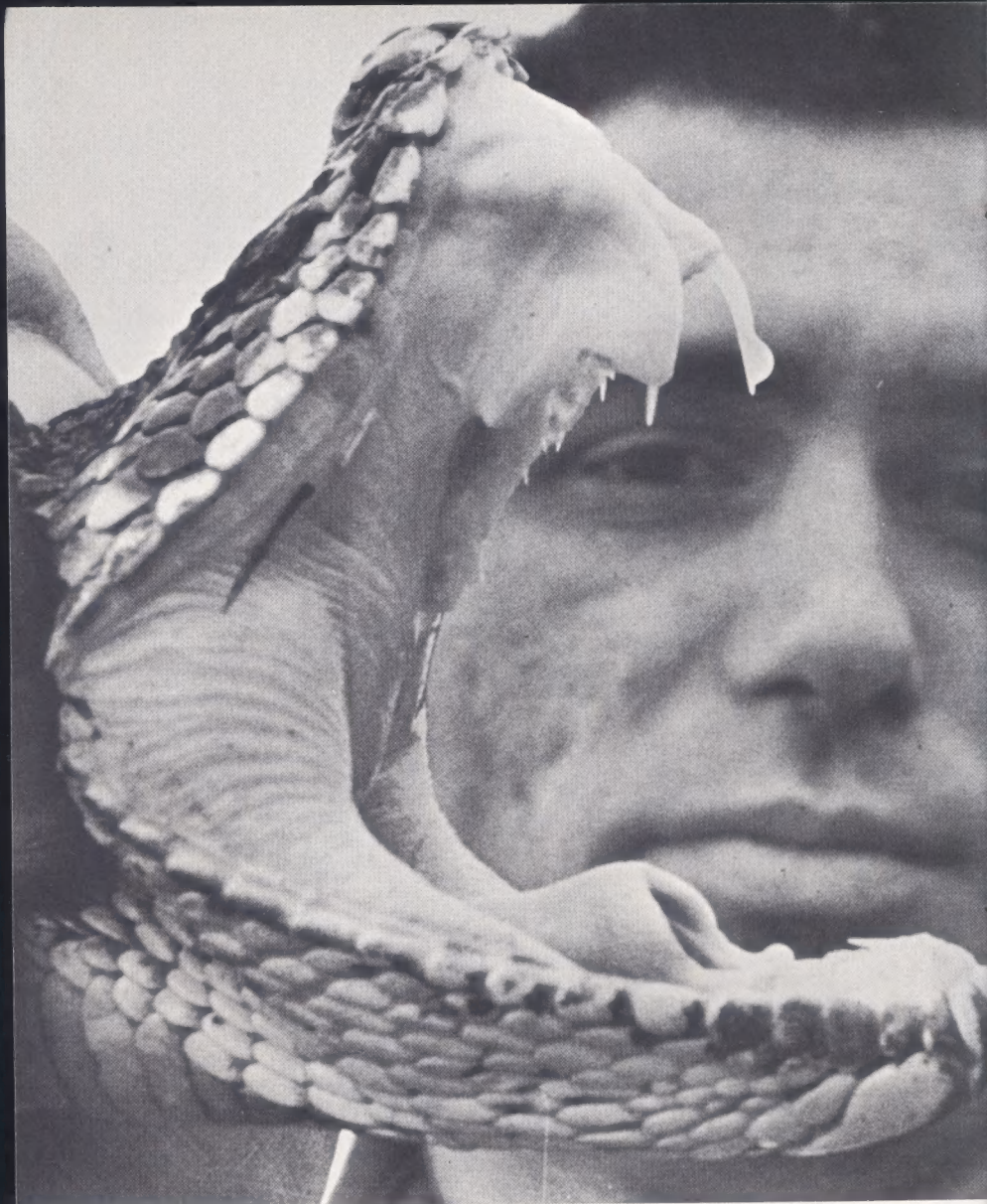
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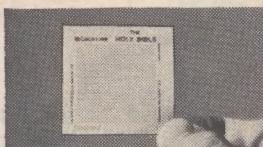


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**A** FEW WEEKS AGO, depending on when you picked up this copy of *Science Digest*, another of a curious and interesting family of satellites was scheduled for orbit. April Fools' Day was the date it was due off. We hope that the Nimbus weather satellite (the one on the cover) made it in good shape this time. The last one goofed up. From the air, you can see its sad remains on the sea bottom off Cape Kennedy.

If it's up there, it will have joined a whole batch of weather eyes—the ATS "Stay-putnics," the ESSA group and the M-ITOS. All of them will help the world's meteorologists to do much more accurate and longer-

## THIS MONTH

range forecasting, with their computerized analyses of what's going on down here, below.

In order to find out how this remarkable eye-in-the-sky network functions, we sent our reporter, Barbara O'Connell, trotting around to a number of ground control centers to see the action. She was impressed.

"Those ESSA machines—a large array of them in a big room—kept flopping out pictures of the world and its cloud cover like chickens laying eggs," she says. "You get the feeling that the whole world is computerized. When a satellite tells ground control that all its systems are 'Go,' the 'Happy Button' on the display panel lights up. If one of them reports a failure anywhere in its works, an operator immediately hits the one labeled 'Panic Button.' Automatic transmission stops and the system goes on manual. It's fantastic." See page 43 for details—*RFD*

# SCIENCE

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**SCIENCE DIGEST** is published monthly by The Hearst Corporation, 959 Eighth Avenue, New York, N.Y., 10019. **RICHARD E. BERLIN**, President; **GEORGE HEARST**, V-Pres.; **RICHARD E. DEEMS**, President of Magazines; **JOHN R. MILLER**, Executive V-Pres., Magazines; **WILLIAM S. CAMPBELL**, V-Pres., Magazines; **ALBERT A. RACHOI**, V-Pres. and Director of Circulation; **RAYMOND J. PETERSEN**, Senior V-Pres. of Magazines; **FRANK MASSI**, Executive V-Pres. and Treas.; **HARVEY L. LIP-TON**, Sec.



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MAY • 1969

Vol. 65, No. 5

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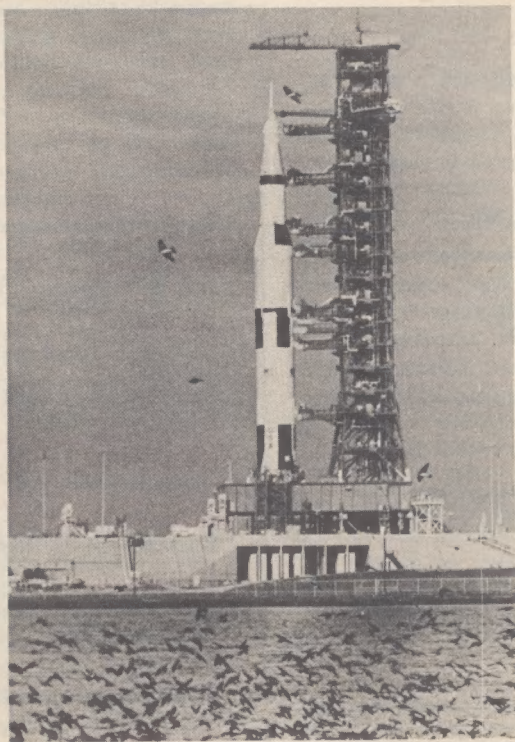
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## NEWS

## IN BRIEF

## Bulletins at press time

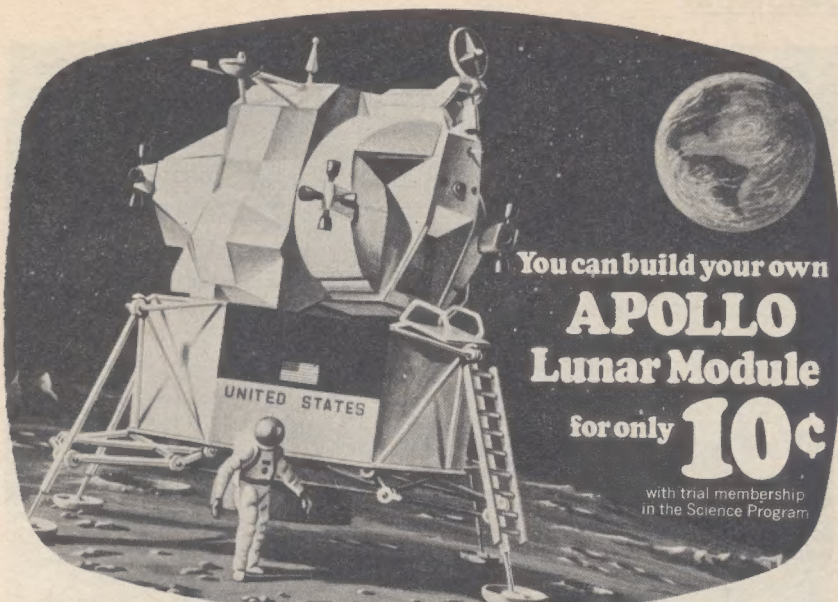


UPI

APOLLO 10 SET TO GO ON MAY 18. Because of the resounding success of Apollo 9 in March, NASA is optimistic that another moon-orbit mission will be possible this month. As of press time, it was hoped that Apollo 10 would begin its trip on the second day of the seven-day period during which the moon is in a favorable position for the astronauts to survey two of the possible lunar landing sites: the Sea of Tranquility and the Central Bay.

WHY SOME PREGNANT WOMEN FEEL FAINT has been determined by doctors at Chicago's Michael Reese Hospital. Dr. Joseph Bieniarz reports that in many cases the uterus which contains the unborn baby causes pressure on a major blood vessel, the inferior vena cava. The squeezing of the vessel occurs most often when the pregnant woman is lying





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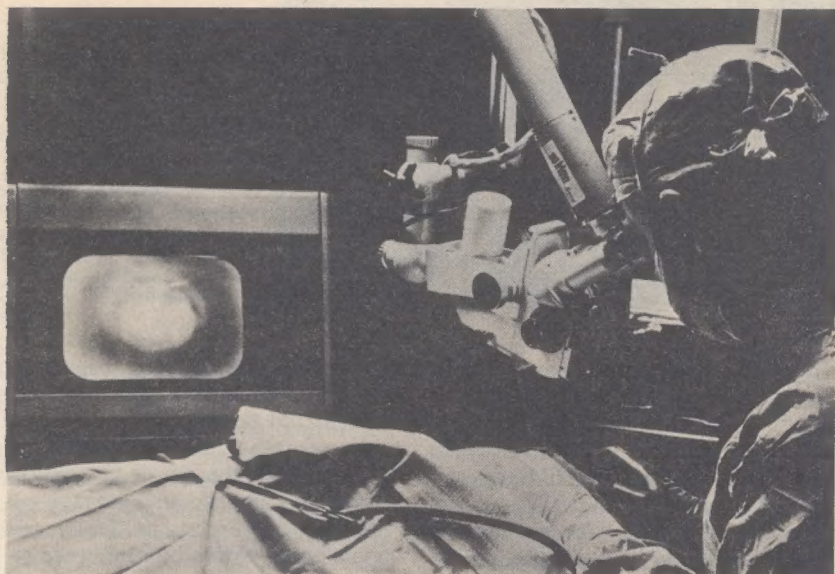
U.S. HAD OVER 250 EARTHQUAKES IN 1968, but nobody was killed. There were 257 significant earth tremors in 21 states, Puerto Rico and the Virgin Islands. The rest of the world was not so lucky, however. Twenty earthquakes took 12,401 lives in 13 other countries. According to the Environmental Science Services Administration of the U.S. Department of Commerce, the last fatality from an earthquake occurred in this country in 1965 in Puget Sound. Seven were killed.

YOUR WEIGHT PROBLEM MAY NOT BE YOUR FAULT, according to the Louisville, Ky., Metabolic Research Foundation. Obesity may be caused by other factors than merely eating too much. The foundation lists four possible reasons why people get fat: 1. An imbalance of body chemistry, especially the thyroid hormone transport mechanism. 2. Emotional shock. 3. A result of other abnormalities such as diabetes and high blood pressure. 4. The result of inbreeding and dietary habits. Doctors are beginning to treat obesity as a chronic disease rather than merely the problem of over-eating.

A NEW PLANET MAY HAVE BEEN BORN, and radio astronomers all over the country are watching it happen. Intense radio emissions from deep in outer space suggest that there are one or more rings of dust swirling rapidly around a central body. Astronomers speculated that the central body may be the beginning of a star and that the swirling rings may be the early stages in the formation of new planets. Among the numerous observing astronomers are Navy scientists Drs. S. H. Knowles and C. H. Mayer of Maryland Point, Md.

THREE "EXTINCT" BIRDS HAVE BEEN REDISCOVERED, according to Secretary of the Interior Walter J. Hickel. Even though the list of rare and endangered species has been climbing steadily in the past several years, conservationists were surprised to find out that the three exotic species, previously pronounced extinct, were still alive in small numbers. They are the Maui Nukupuu of the Maui Island in Hawaii; the Molokai creeper, also of Hawaii; and the Puerto Rican plain pigeon.





All photographs BIPS

Now surgeons have a new weapon against cancer, heart disease and strokes. They operate under a microscope and call it...

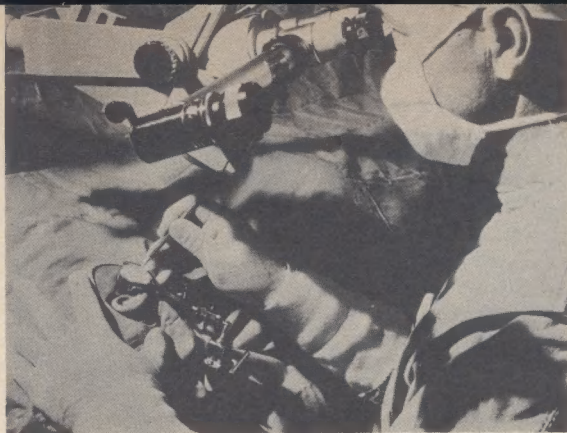
## Microsurgery: medicine's big new hope

by Arthur S. Freese

**A** WOMAN we'll call Ruth Wilson is fiftyish, nice-looking, intelligent. Until recently, she was a competent executive secretary. But a condition that began as momentary flashes of excruciating facial pain steadily worsened, affecting both her job and personal life.

The moments of pain, caused by a common neuralgia, became more frequent and lasted longer. Eventually the faintest touch on a spot the size of a nickel between her right nostril and the right corner of her mouth set off agonizing, lightning-

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Binocular microscope enables surgeon to perform stapedectomy, a delicate operation on the tiny bones of the middle ear. These bones transmit sound vibrations to the inner ear. The operating microscope has made it possible for surgeons to completely reconstruct the middle ear. Other previously impossible or extremely difficult ear operations are also now performed with success.

like jabs. Even the slightest draft produced the pain. Ruth came to live in dread of these spasms of pain, which occurred so often and so severely that she couldn't hold her job.

Ruth finally was advised she needed a new type of operation—a revolutionary surgical technique that allows surgeons to concentrate on areas formerly considered too small. Called microsurgery, this technique employs a microscope to perform new miracles of healing—to restore vision and hearing, to aid in the fight against cancer, to correct weakened blood vessels, to perform operations on the brain and spinal cord. One of the most successful uses is to cure problems like Ruth's.

Ruth's ailment was diagnosed as "tic douloureux," or trigeminal neuralgia. The condition was first recognized by a Greek physician nearly 2,000 years ago. Its name comes from the facial paroxysm—tic—which victims show during each flash of pain, or douloureux.

Until recently, relief could be obtained only by cutting the entire trigeminal nerve—the source of the pain. But such an operation often resulted in a loss of sensation on the face, which some people considered almost as bad as the pain itself. Also,

the surgery sometimes damaged the corneal reflex, which causes the eye to blink and tears to flow when anything gets into it. Without this means of protection, the eye is susceptible to infection and eventual damage.

With microsurgery, tic douloureux can be cured without harming the reflex or eliminating the sense of touch. The new operation was devised by Dr. Robert W. Rand, professor of neurological surgery at the University of California at Los Angeles, and Dr. Peter J. Jannetta, associate professor of neurosurgery at Louisiana State University.

Dr. Rand explains the necessity of using the microscope for this surgery: "The hands can only do so much as the eyes can see. The operating microscope provides magnification and acts as an excellent source of light—up to 2,000 foot-candles. This makes it possible even to see down into the brain cavities."

Ruth became the latest beneficiary of this new medical advance developed by Drs. Rand and Janetta. She was wheeled into a conventional operating room, filled with gowned and masked surgeons, anesthetists, nurses, instruments and lights. But a few extra pieces of equipment made this operating theater different.



Stools with backrests and arm supports were provided for the surgeon and his assistant. Alongside the operating table stood a five-foot-high pole, painted battleship gray, rising from a heavy tripod base. At right angles to this pole, a five-jointed arm supported something wrapped in a transparent drape. Inside this sterile bundle was a bulky device with a pair of binoculars and a small television camera pointing downward toward the table. Eyepieces and lenses protruded through openings in the wrapping.

Ruth's operation was performed under this operating microscope. The surgeon observed the tissues enlarged as much as 40 to 50 times; the camera televised the procedure for the medical team. The surgeon adjusted the scope's zoom lenses without using his hands, by merely touching a foot control unit with seven control buttons.

The operation was based on the discovery by Drs. Rand and Jannetta that there is a distinct bundle of fibers within the trigeminal nerve whose compression by blood vessels appears to be the cause of tic douloureux. The surgeon cuts only these fibers, eliminating the sensations of pain and temperature, but preserving the feeling of touch and the corneal reflex. About 15 patients with tic douloureux have been cured by this operation during the past three years.

Dr. Rand points out that the technique also has been used in the removal of acoustic tumors. Where formerly 90 percent of these patients lost control of the facial muscles, he says, "we now preserve not only this facial nerve, but at times the vestibular and cochlear nerves as well (these are for balance and hearing).

"We have discovered what we call the 'steal syndrome,' " adds the surgeon. "This is a condition in which patients develop various degrees of numbness, weakness, clumsiness, even paralysis of the legs due to a vascular anomaly (irregularity) of the spinal cord which causes these blood vessels to steal blood, oxygen and nutrition from the nerves."

"With the microscope, we can see the exact blood vessels involved, then eliminate them completely with either surgery or electrocoagulation, thus permitting the spinal cord to return to normal in many cases," says Dr. Rand.

The first microsurgery was performed some 16 years ago by otologists—specialists in the care of the ear. Professionally, these doctors are termed otorhinolaryngologists (ear-nose-throat specialists). Today, microsurgery is an accepted technique for delicate ear operations.

"We wouldn't think of performing otological surgery without the binocular microscope," says Dr. Jules G. Waltner, associate professor of clinical otolaryngology at Columbia University. "Without it, we couldn't do 80 percent of the surgery we now do successfully."

The ear consists of three parts—outer, middle and inner.

The operating microscope, explains Dr. Waltner, has made possible the reconstruction of this entire middle ear, with its eardrum and minute ossicles. Removal of the stapes and its replacement with a stainless steel or tantalum wire—even a Teflon piston—have restored normal hearing in 95 percent of suitable patients, the specialist says.

Acoustic nerve tumors are only one type of cancer to yield to micro-



Closed circuit TV enables up to 30 doctors to study microsurgical procedures at the same time. Screen on the left shows surgeon performing an operation; on the right, the monitor shows a portion of the middle ear being operated on transmitted directly from the operating microscope.

surgery. With the operating microscope showing the way, the rhinologist (nose specialist) can remove tumors of the pituitary gland by going through the nose, then through the sphenoid sinus, to reach the gland.

According to Dr. J. Lawrence Pool, professor and director of neurological surgery at Columbia University, "Microsurgery is being used more and more—not only for the brain, nerves and circulation, but also for the spinal cord, small nerves and blood vessels."

Doctor Pool reports he has utilized the microscope to operate on babies with congenital cysts at the base of the spine and to save and repair nerves damaged at birth.

An adaptation of the operating microscope has been developed to aid laryngologists in throat surgery. Ernest Young, an athletic-looking high school science teacher, needed such an operation.

Ernest, a six-foot-tall, 200-pound specimen, was plagued with persistent hoarseness. This condition grew to last as long as three weeks at a time. A throat specialist spotted a growth on one of the teacher's vocal cords, and recommended that surgery be performed.

The conventional laryngoscope, used for such operations, is essentially a hollow metal tube equipped with lights. It is passed down through the patient's mouth and throat so that the doctor can see into the larynx (voice box). Unfortunately, this small tube permits the use of only one eye, as with a telescope.

For Ernest's operation, a special binocular microscope was added to the surgeon's equipment. A plastic tube, less than one-third inch in diameter, was slipped down past his mouth and larynx, carrying anesthetic gases directly into his lungs. Then a laryngoscope was passed down to the vocal cords.

Using the operating microscope, the doctor watched with both eyes as he guided his delicate, long-stemmed instruments through the laryngoscope to the vocal cords. There, he removed a benign polyp.

Operating microscopes and surgeons' instruments have come a long way since otologists first began performing microsurgery 16 years ago. Binocular microscopes often have two sets of lenses, one for the surgeon, the other for his assistant. They can be adjusted separately so



that each doctor sees only his own field, or arranged so that both may examine the same area.

Still, movie and television cameras attached to the instrument record procedures. Twin still cameras can provide stereoscopic pictures. Ophthalmologic operating microscopes are equipped with special lights for maximum illumination.

Magnifying power of modern operating microscopes ranges from  $2\frac{1}{2}$  to 53X. Zoom lenses are controlled by foot switches, enabling the surgeon to adjust the scope without removing his hands or eyes from the operating field.

The surgeon's equipment also has undergone many changes, partially because a 40X magnification can make conventional surgical instruments look heavy and crude. To maintain smooth action, special spring handle appliances were devised. Pneumatic and hydraulic controls also make it possible to open and close instruments smoothly.

Special suture materials that are almost invisible to the naked eye—one-quarter the thickness of a human hair—have been developed.

Surgery on small blood vessels and nerves may open exciting new areas for the operating microscope.

For example, small blood vessels at the base of the brain which cause strokes may be corrected by microsurgery if the condition is caught early enough, reports Dr. Julius H. Jacobson, director of the vascular surgical service at New York City's Mount Sinai Hospital.

As we become more sophisticated in our transplants, microsurgery will become more important. It will be needed for such things as adrenal glands and other small organs," pre-

dicts Doctor Jacobson. "In rats, the microscope has made transplantation of kidneys possible. However, the greatest use of microsurgery may prove to be in the treatment of strokes and coronaries."

Repair of cut nerves in injured extremities may be another important field for microsurgery. In the past, when patients suffered cut main nerves to the hand, the sensations of touch and full use of the fingers have rarely been recovered fully.

Dr. James W. Smith, assistant professor of clinical surgery at Cornell University, sees hope for these patients in microsurgery.

"Under the microscope," Doctor Smith explains, "we can see a framework which can be used to locate the parts which fit together—a blood vessel on the outside of the nerve, a somewhat oval shape, different sizes of fiber bundles. We're trying to get a repair so accurate that Mother Nature won't even know that anything has been done, and the regeneration will be fast enough to save the muscles, which degenerate without their nerve supply."

Obviously, microsurgery is only in its infancy. Today, surgeons are perfecting the technique for operations on the brain, spinal cord, eyes, ears, throat, blood vessels and nerves. Tomorrow it may make possible transplants only dreamed of today. It may enable major advances in the battles against heart disease and cancer. In the words of one expert, "The future of microsurgery is limitless."

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#### For further reading

*"Camera's Eye Sights Trigeminal Fibers."* Medical World News. McGraw-Hill. May 17, 1968. Pages 23-24.

## GEOMETRY

Can you spot the hidden figures and other tricks in some of the old masters' paintings? Many of the great artists were also masters of perspective and expert draftsmen. They often couldn't resist the temptation to show off a little in their work to prove that they were just as aware of science as of art.



The mysterious object in the foreground of "The Ambassadors," by Hans Holbein, has been enlarged at the right. To identify the object, close your left eye and hold the right side of the picture against your cheek. By looking down the length of the object you will see ■ seem to condense into ■ recognizable form—a grinning human skull. It is a good example of Holbein's foreshortening ability.

## Jokes the old

by Paul Brock

SOME very special jokes were played more than 400 years ago—and people are still chuckling. These were no ordinary jokes, and the fact that some of them were "dirty" has nothing whatever to do with why they have lived so long.

In fact, art schools all over the world use these jokes as the "ultimate example" in teaching the science of perspective to art students. Why? Because these jokesters were artistic masters who not only produced great art but also couldn't resist the temptation to crack a subtle joke or hide a puzzle somewhere in their paintings.

Some of the more famous of the old masters were fascinated by puzzles and problems involving the science of perspective and the art of foreshortening. These puzzles took

superlative skill to create and comprehensive knowledge to solve.

Hans Holbein, for instance, painted a masterpiece called "The Ambassadors" (above) in which he deliberately inserted puzzles and mysteries. The painting was done in England in 1533, and it now hangs in London's National Gallery. It shows Jean de Dinteville, the French Ambassador in London, with his learned friend Georges de Selve.

The artist has literally crammed the canvas full of subtle tricks and riddles. Many of them can't be seen unless you look at the original painting—even then they're hard to spot. Little details like telling the ages of the two men in the painting: De Dinteville's age (29) is hidden on the sheath of his dagger. De Selve's (25) is on the edge of a book underneath his right elbow.

Nearly all the objects and sur-





## masters used to play

roundings in the painting have topical, personal or political significance connected with Tudor days. But at the bottom of the painting, between the two men, is a mysterious object which is neither fish, flesh nor fowl. This object is often mistaken for the artist's palette or his flippant version of a dried fish—possibly a shark. But what it *really* is doesn't become apparent until the painting is looked at from the right side with the cheek close against the picture.

Keep your left eye closed and your right directed downwards along the length of the object. You'll soon see the object close up like a concertina and become, in perfect proportion, a human skull.

The skull or *Memento mori*, the Remembrancer of Death, was common enough in medieval art, and perhaps a death's head was the heraldic device of the Ambassador de

Dinteville. At any rate, in the original painting a tiny skull can be detected upon his cap.

But why did Holbein make a puzzle out of a death's head? Almost certainly because all his fellow-painters knew that he was a master of perspective and of the difficult feat of foreshortening. Perhaps he wanted to show the puzzle-picture artists of the day, who were experimenting with the rules of perspective, that he was just as great a master in the reverse process of *forelengthening*.

Artists know that there are two types of perspective—linear and atmospheric.

"Linear perspective," says Samuel Gore, head of Mississippi College art department, Clinton, Miss., "is really the studio term for descriptive geometry or the science of projection at which Holbein and a few of the other masters so excelled.



The bizarre painting above is a puzzle painting that is intended for viewing from the side in the same fashion as the "Ambassadors." If you hold it to your cheek with one eye closed, you'll see the distorted figure close up and become just like the picture at the left. The painting was done in the 16th century by an unknown artist, and the subject is King Edward VI of England at the age of nine. It was intended for viewing from a special peep-hole in the side of the frame. It hangs in the National Portrait Gallery, London, Eng.



"It governs the outlines of objects as they appear in drawing and painting, and is easiest to explain when architectural masses—or any other rectangular masses—are drawn on a flat surface like that of the artist's canvas."

When this is done, certain rules of perspective become apparent: All horizontal lines receding from the eye appear to slope upwards or downwards toward the horizon level or eye level. Those below the eye

level appear to slope upwards and those above the eye level downwards. The further below or above the eye level such horizontal lines lie, the steeper is the apparent slope upwards or downwards.

Parallel horizontal lines appear to come nearer together the further they recede from the eye. If extended they would meet on the eye (or horizon) level at a point called the vanishing point. For horizontal lines at right angles to the picture plane, the vanishing point is on the eye level immediately in front of the eye, known as the center of vision. The lines to the left of the center of vision slope upwards or downwards to the right; those to the right slope to the left. Horizontal lines at any angle to the picture plane other than a right angle have their own vanishing point to the right or left of the center of vision.

Vertical lines appear to remain vertical, but a series of vertical lines of the same height and at equal dis-



tances from each other, appear to become shorter and nearer together the more distant they are from the eye. The sketch at the bottom of this page is a good illustration of the principles of perspective.

Holbein's subtle joke in linear perspective is equaled in cleverness by the sleeping lad in Aelbert Cuyp's masterpiece, "Horseman and Cows" (page 17). Cuyp (1620-1691) was the dominating figure in Dutch landscape painting, and his perspective excellence is unmatched. The design of his "Horseman" is absolutely correct mathematically, the whole composition being based upon a sharp diagonal which completely dissects the picture.

But it is his superb foreshortening technique that makes this painting equal in genius to Holbein's "Ambassadors." Lying with his head into the picture the lad is very much foreshortened, but if the picture is placed in a good light and then moved first to one side and then to the other, the lad not only lengthens out, but completely turns about.

At the same time, the man, the boy standing and the dog retain their positions—but the horse turns half around and so does the foreshortened cow in the right-hand corner of the picture.

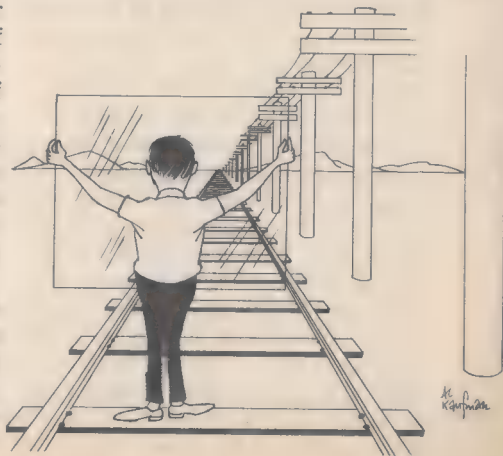
One other great picture, Francesco Guardi's city scene, "Piazza San Marco, Venice," (page 16) shows another masterful trick of perspective. The vista runs straight away from the eye.

Looking at the picture from the left, the houses swing around in the most amazing way. Looking at it from the right, they swing in the opposite direction. In addition, the piazza lengthens out. The foreshorten-



This portrait of a girl will seem to follow you around the room if you place it at eye level and stand to the right of it. At this point the girl's head is turned toward you. Now walk away to the left of the picture. Her head and neck are once again turned toward you.

Science of linear perspective can be illustrated by cartoon below. The railroad tracks and telephone lines seem to come together at a point on the horizon called "vanishing point." Man holding transparent sheet shows how the perspective would appear on canvas.





"Piazza San Marco, Venice" by Francesco Guardi is a masterful trick of perspective. Notice how the two sides of the square change direction when looked at from left or right. Especially notice, too, the change of direction in the line of shadow on the right side of the square.

ing is no longer evident when you change viewing positions.

The masterpiece is often used to illustrate the laws of parallel perspective.

This "swinging around" phenomenon is not unique, however, and there are many examples of portraits in which the head and eyes follow one around the room. "Head of a Young Girl" (page 15) by Jean Baptiste Greuze (1725-1805) is one.

If this painting is placed on a mantelpiece at eye level, and the observer stands to the right of it, the girl seems to be turning her head towards him. If he walks away to the left of the picture, both head and neck appear to have turned again toward him. In many pictures the eyes alone seem to follow the viewer around, but in this case the artist has achieved the remarkable effect of making the whole head and neck

turn one direction or another.

The popularity of puzzle paintings was enormous, and many artists took advantage of the demanding market. It wasn't unusual for a viewer to apply his eye to the side of a painting and discover a half-clad female in an erotic pose lurking in the background of an otherwise sedate painting. Medieval "peek-a-boo shows" must have been infinitely more sophisticated than their modern counterparts.

"Painting is a science," famed English artist John Constable said, "and should be pursued as an inquiry into the laws of nature." Yet Plato, far from calling it a science, condemned it as trickery—the trickery of sculptors who lengthened the proportions of statues meant to be seen from below, because they failed to represent things as they "really are."

Modern painters call this "ana-





Place this painting, "Horseman and Cows" by Aelbert Cuyp, at eye level and stand to the right. The horse turns toward the left side. Walk to the left, and the horse seems to turn toward the center of the picture. The position of the sleeping boy also changes as you walk to the left.

morphosis"—the distorted representation of an object which appears normal and in correct perspective when looked at from a certain angle or when reflected from a convex or concave mirror. A good example is the anamorphic portrait of Edward VI in the National Portrait Gallery, London, painted by an unknown artist in 1546.

At first sight the painting (page 14) looks like a hideous caricature, and because it is so grotesque, it attracts immediate attention. Near it is a printed notice directing the visitor to apply his eye to the peephole provided in the frame on the right side.

The result is a complete surprise, for the hideous face is instantly transformed into an average-looking boy—a bit long in the nose and weak in the chin, maybe, but certainly not ugly. It is an excellent painting of King Edward VI at the age of nine.

About this time such puzzle pictures were all the rage, and many prints were made and sold, especially in Germany. Looked at in the ordinary way, they appeared to be childish attempts to draw a landscape. Probably underneath would be the words: *Was siehst du?*—"What do you see?"

The viewers would apply an eye to the side of the picture and, as a rule, see voluptuous courtesans, partially-dressed ladies or portraits of the artists themselves, grinning at their own perspective cleverness and cupidity.

### For further reading

How to Use Creative Perspective. *Ernest W. Watson*. 1955.

The Picture History of Painting. *H. W. Janson and Iora Jane Janson*. *Harry N. Abrams, Inc., Publishers*.

## NEW FOR PEOPLE

You can fry an egg on the top of a glass coffee table thanks to a new spray-on, roll-on coating that conducts electricity. Acheson Colloids Co., New York, N.Y., developed the coating, which consists of ultrafine particles of a conductive material such as graphite or silver contained in a liquid resin that will stick to almost any surface. You may even be able to solve the problem of heating your home by simply spraying a coating of the material on your walls and then painting right over it. Heating can be accomplished then by the simple turn of a switch or a standard thermostat. In fact, heat can be supplied just about anywhere—the bottoms of frying pans, food warmers, etc. Better TV pictures, too, will be possible by coating the inside of picture tubes with a similar coating.



London police are demonstrating two new crime-fighting weapons recently developed in England. Policeman at the top is receiving a suspect's photograph that has been transmitted electrically by a Muirhead Mobilefax machine. Patrol cars will be equipped with the picture machines which can also transmit fingerprints, physical descriptions and other important data in less than 15 minutes. The officer at the right is using a mobile optical telephone which transmits speech over a beam of infrared light. Its operator first focuses the infrared beam through a set of binoculars. The communications device is designed to operate during times when normal communications have broken down. It is effective up to one-half mile. Both devices are being tested at Ryton-on-Dunsmore, near Coventry.

Keystone



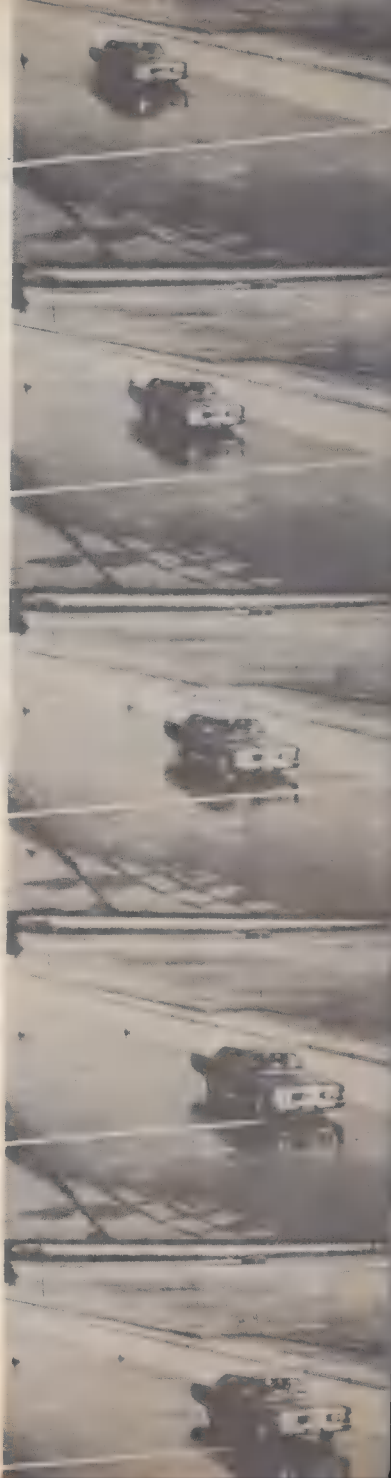


Artificial lightning and static electricity for the science classroom is produced by an electrostatic generator at the left that can create electrical sparks of up to 85,000 volts. Developed by the Raytheon Co., the teaching device is available from the Macalaster Scientific Co., Nashua, N.H. Unlike other generators, this device is not affected by humidity. It was recently shown at the American Assoc. of Physics Teachers convention in New York City.

A shorter stopping distance for passenger vehicles may be possible because of a skid control device developed by the Borg-Warner Corp. in Detroit. Skids are prevented by automatically pumping the rear brakes whenever they are pressed hard—conventional brakes lock the wheels when pressed too hard. The photo sequence at right shows a smooth stop on wet concrete without swerving or skidding—even though the brakes were slammed on hard.

The burglar-proof lock below has no conventional key—it works by coded magnetism. Its only "key" is a small magnetic block which is coded to open the lock. There is a brief whirring sound when the magnet is pressed to the lock, and when the whirring stops, all you have to do is press gently and the box opens. There is only one magnetic code that will fit each lock. The device was invented in West Germany by Melsunger Metallwerk.

BIPS





Photographs by Bob Combs

*Many experts in the field of drug addiction are now stressing the addict's physiological dependence and are turning to narcotic substitutes and antagonists as the best way to get addicts off heroin and back into society. Psychiatrist Efren Ramirez takes a different tack. He stresses rebuilding the addict's character.*

*Dr. Ramirez has already had considerable success with his theory. In his native Puerto Rico, where he ran a treatment center for addicts, only seven of the first 124 addicts treated had gone back to taking drugs 3½ years later. That is a relapse rate of 5.6 percent versus a rate of nearly 92 percent for addicts treated in federal institutions. Because of his success, Dr. Ramirez was recruited by Mayor John Lindsay to tackle the problem in New York, where 50 percent of the nation's addicts live.*

*Dr. Ramirez served as the Addiction Services Agency's Commissioner for a little over a year, and during his service, more than 1600 addicts started his three-phase rehabilitation program which takes from two to three years to complete.*





Two New York City drug addicts are "main-lining"—injecting heroin into a main artery.

## Drug addiction is not physiologic

by Efren E. Ramirez, M.D.

**W**HEN I began working with addicts nine years ago, I was told that addiction is a chronic, incurable disease. I no longer believe that. Instead, I am convinced that addiction can be cured. I am also convinced that there is no such thing as purely physiologic addiction and that the addict's problem results from a fundamental but treatable character disorder.

The typical addict has a weak sense of responsibility, little commit-

ment to anyone or anything. His life is dismally disorganized and he can't seem to learn from his failures. He shows poor motivation to be cured, and the current belief that addiction is physiologic just gives the drug addict another excuse for saying, "I can't help myself."

But the addict *can* help himself. In fact, he is the only one who can effect a cure.

Most psychologists and psychia-

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Scenes like this can be stopped, according to Ramirez, only if the addict himself can find the strength to rebuild his character and personality. This typical addict from a Harlem slum is shown injecting heroin into an artery.

trists who try to cure addicts become upset and discouraged by their failure to respond to treatment. These professionals are usually trained to handle psychological problems that are fundamentally emotional. Their neurotic patients may have many emotional conflicts, but they have basically solid characters. These patients work with their psychiatrists and respond emotionally to therapy. The addict does not. And because he never appears to suffer significant emotional pain, he may repel the psychiatrist who is trained to help people reach and deal with their feelings.

The addict's lack of motivation also works against the psychiatrist. Orthodox psychological treatment depends on the addict's desire for rehabilitation. The absence of true motivation for a cure is part and parcel of the addict's character disorder.

I do not mean to imply that addicts cannot be reached. On the contrary, I believe everyone wants to become a complete human being. But addicts have not built a psychological structure for following through on their desires. What they need is proof that they can change. This is where the former addict comes in.

Ex-addicts play a major role in the program I have developed. To some extent, my reasons for using them are pragmatic. Lack of money and experienced personnel is no excuse for not taking action; one must use the means at hand. When I had little else, I did have some ex-addicts who



were willing to help other addicts.

A more important reason for using former addicts is that they are the most valuable agents of help we have in trying to reach the person who is still taking drugs. The ex-addict can accept the emotionally shallow and callous characteristics that distress psychiatrists. He can put down the addict for copping out, whereas psychoanalysts might spend their time just trying to understand the addict. And the ex-addict can offer himself as living proof that a cure is possible and desirable.

When the addict first comes into one of our six store-front Phoenix Centers, which are located in neigh-





borhoods with ■ high incidence of drug users, he usually recites the familiar excuse for feeding his habit: "You know my body craves drugs. I can't live without them." But these lay experts of ours—these ex-addicts—ask him, "What can you do for yourself?" Gradually, using language the addict understands, they persuade him to come to the center every day. The next step is to cut down on his habit a bit. The third step is to get him to enter our program. Actually, if he takes the first two steps, he's already in the program. So skillful are these ex-addicts that our Phoenix Centers hold on to 50 percent of the addicts who walk

in the door and ask for help.

After the addict develops enough of a sense of responsibility to himself to enter the program formally, he stays in a hospital ward for several weeks. There, if he hasn't already come off the drug as a patient at a part-time care center, he is detoxified. In our New York program, 30 of the first 32 addicts admitted to detoxification wards were already clean.

The most intensive phase of the program takes place in ■ full-time therapeutic community called Phoenix House. For nine or ten months, the addict is relentlessly confronted, day in and day out, with his own

character faults. These shortcomings are thrown up at him by addicts, ex-addicts and professionals. The aim of these confrontations is to undermine his destructive attitudes and to reinforce his productive attitudes. The addict begins to be bothered by guilt and anxiety. Gradually, his defeated, distrustful and hostile attitude becomes re-oriented toward realistic goals.

By the time the addict reaches the re-entry phase, the program's basic treatment is complete. However he still needs help in making the transition from the therapeutic community to the general society. A few addicts are given permission to live at home during this final phase. But most of them live in a residence called Phoenix Re-Entry House, where they, for the most part, run things.

Work with other addicts in the program is an important part of the re-entry phase. First the addict—now an ex-addict—works as a clinical aide in detoxification wards. Next he becomes a clinical assistant to the staff of a part-time care center. Then he moves on to be a full-time aide in a therapeutic community, sometimes leading the thrice-weekly group encounter sessions. Finally, he is ready for work in a Phoenix Center. There, he is the one who says, "Look, it can be done," to addicts who venture in out of curiosity or for real help.

Throughout this re-entry phase—which may last about a year—the addict is watched carefully. After a final social, psychiatric and vocational evaluation by all those who have worked with him, he receives a certificate of rehabilitation. Once certified, the ex-addict can count on the official backing of the City and the State of New York in his efforts to

find a respectable, productive place in our society. This is our assurance to him that his involvement in the long rehabilitation program will be rewarded, that he will be socially and vocationally accepted on equal terms with non-addict citizens.

But this is an empty assurance if we do nothing more than rehabilitate the addict. We must also train the society he's returning to.

Here and in Puerto Rico, I have observed that many straight people in the addict's world—friends, relatives, acquaintances—have an unconscious stake in keeping him hooked. They get a vicarious thrill out of seeing him dependent on drugs. So helping these nonaddicts to develop an awareness of the addict's problems and a sense of responsibility toward finding solutions is an integral part of our program. Toward this end, we have set up two city-wide organizations—Rehabilitation of Addicts by Relatives and Employers (RARE) and Addiction Workers Alerted to Rehabilitation and Education (AWARE). We hope that a quarter of a million people will eventually be enrolled in these groups.

Our New York City program is still too new to have graduated any ex-addicts. But 80 addicts are now in the first stages of re-entry. They know that our program will not do anything *for* them or *against* them. It will only do things *with* them. And they seem to be responding.

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#### For further reading

Marijuana: The Facts, the Truth. *Will Oursler. Paul S. Eicksson, Inc., Publishers 1968.*

Mind Drugs. *Edited by Margaret O. Hyde. McGraw-Hill. 1968.*



## Sno-Cat for Springtime mud

**T**HE BIG SNO-CATS that have carried men and tons of equipment across the frozen continent of Antarctica to the South Pole were the inspiration for ■ new breed of cat—the all-purpose Sno-Cat.

Originally designed to operate in ice and snow, the Sno-Cat, built by the Tucker Corp., Medford, Ore., has been revamped to operate in water and mud. Looking like a cross between an armored tank and some sort of hybrid jeep, the vehicle can operate in environments that would be dangerous if not impossible for conventional vehicles.

It rides on four sets of tread-covered pontoons that enable the machine to travel over practically any kind of terrain. The Sno-Cat takes to three feet of water without a hitch and can scale an almost vertical, eight-foot incline simply by adjusting its pontoons to the contour of the land.

In a recent test run the vehicle was driven down the center of a creek in waist-high water. It then proceeded to scale the steep banks of the creek, knocking over willow trees as it went.

Designed by Emmitt Tucker, president of the concern, the vehicle holds great promise as an all-purpose machine for use in underdeveloped countries. The versatility of its design, its lightness and the adaptability of each pontoon in adjusting to the contour of nearly any terrain make the machine ■ candidate for a wide variety of uses. In the U.S., one of the major applications of the vehicle is in fighting forest fires.

The present model, which is protected by patents in various countries, is driven by a 175-horsepower Chevrolet motor, but there are plans for a much larger machine with a more powerful motor. This Sno-Cat of the future, according to its designers, will carry as many as 100 people over nearly any terrain in the world.





Ever wonder what it was like to live 5,000 years ago? A Danish archaeology student's curiosity got the best of him so he decided to find out for himself about Stone Age and Iron Age men. He set up two villages where ancient man has been "reborn" to tell modern man what it was like. And some amazing things have been learned—things no one knew until now.

**12 things  
nobody  
ever knew  
about  
Stone Age  
and  
Iron Age  
men**



by Laurence R. Griffin

**A** TEST-TUBE STONE AGE was the dream—recreate the world of ancient man and then *live* in it. The idea was Hans Ole Hansen's, ■ young Danish archaeology graduate student who believed that the only way to really discover how ancient man lived was to bring the past back to life—not vague archaeological generalizations, but ancient man's actual day-to-day existence.

The plan was to set up two villages—one that would be typical of the New Stone Age (Neolithic Period) which began in Denmark over 5,000 years ago. The other village was to be representative of the Iron Age, usually thought of as dating

from around 400 B.C. to A.D. 500, give or take a few centuries.

In these villages Hansen and his fellow student, Svend Nielsen, launched the Historical Archaeological Experimental Center, and put into practice an idea that numerous other archaeologists had been toying with, but, at that time, had done little about—"imitative experimentation." In 1964, their two villages were built as places where they would imitate the past by living the way ancient Danes had lived. They built ancient-style houses, farmed the land, bred farm animals, wore rough animal skin clothes and worked with duplicates of ancient tools.

Hansen had two motives for founding the center. First, he wanted to establish a testing laboratory for the use of archaeologists, anthropologists or members of any other branch of science interested in man and his past. The villages would be comparable both in scope and purpose to the chemist's or physicist's research laboratory.

Second, he wanted to educate the public by giving them "living history," demonstrations manned by student volunteers and regular staff workers, illustrating such primitive skills as hand weaving or pottery making. In short, he wanted to show how Stone and Iron Age peoples lived.

In the past four years since the villages have been occupied, some discoveries have been made about ancient man that nobody was ever really sure of before. Each of the discoveries was made as a result of imitative experimentation—Hansen and his staff set up an imitation of the Stone and Iron Ages, and in so

doing learned what it must have been like to be alive in ancient times.

1. **The Hama Mystery.** Some years ago a Danish archaeological team turned up a number of puzzling triangular shaped stone slabs near the city of Hama in western Syria. Some archaeologists insisted that the stones, all of which bore obvious signs of wear, had served as digging implements, representing a crude form of spade. Other experts thought they were plowshares. But despite a wide range of pet theories, no one could say for sure just what the actual function of the slabs had been.

### ***Skilled artisans at work***

The arguments raged on but the solution remained buried in the dust of centuries—until the center took part in the dispute. Obtaining one of the stones on loan from a cooperating museum, the center had it copied by one of its various workshops. These permanent workshops, staffed by artisans versed in such skills as stone-cutting, metalworking, primitive weaving and pottery manufacturing, turn out the many reproductions of ancient tools and other artifacts needed for the center's numerous experimental programs.

First, Hansen and Nielsen fitted a straight wooden handle to the stone and then tried it out as a shovel, finding almost immediately that the slab made a clumsy, inefficient digging tool. So they tried it out as a plow.

Using as a pattern the design of one of the most basic types of primitive wooden plows, the workshop put together an implement sometimes called an "ard." The stone was lashed to the ard, and it was tried out in a nearby field for several

hours every day. The first thing that they discovered was that the slab made a much better plowshare than it had a shovel, goring out even furrows with relative ease.

In a few weeks, the stone was detached and examined. Sure enough the slab had acquired wear marks identical to those on the original stone. Danish archaeologists now feel that the Hama mystery has been satisfactorily solved.

2. **The ancient farm animals.** When the center decided to try to find out if the Hama stones were really plowshares, they made use of what archaeologists had always suspected were heavy animal yokes. These artifacts had been repeatedly discovered near the sites of ancient agricultural settlements. Archaeologists had long thought that early man utilized animals, most likely oxen, to help him with his plowing chores, but nobody had ever put the theory to a test. So in true Iron Age fashion, Hansen and Nielsen hitched the yoke to an ox to see what would happen. The yoke, the ox and the plowshare worked together in efficient harmony, and thus proved what had always been merely a theory.

3. **Building techniques.** There is really not too much difference between Stone and Iron Age housing construction methods. The houses are actually more like huts and are built around a heavy rectangular framework of rough-hewn logs which is closed in with rough timber siding made weathertight by a thick coating of clay and thatching. The roof is made of sod.

To test his theories of ancient housing, Hansen builds these huts and then sets fire to them and lets



them burn down to the earthen foundations. Then he carefully sifts through the ashes and compares what's left with the excavated ruins of an actual primitive dwelling that appears to have been destroyed by fire thousands of years ago. From this the center has been able to get a good idea of how ancient man must have built his home.

**4. How he heated his house.** Hansen is also interested in finding out the practicability of ancient house designs under day-to-day living conditions. Both scientists and students have spent weeks in reconstructed Stone and Iron Age dwellings. And even though the nighttime temperatures have often fallen as low as 5° F., they at no time have experienced any real discomfort. All they have needed to keep warm was a small fire.

**5. Ancient tools.** When you see an ancient tool in a museum, it tends to look crude, clumsy and inefficient. Surprisingly, live-in projects such as this have demonstrated that the ancient Danes' houses, tools and other devices all performed remarkably

well—much more efficiently, in fact, than most experts had previously believed possible. This was determined by day-to-day use of many of the tools such as hammers, crude wood planes, axes and digging implements.

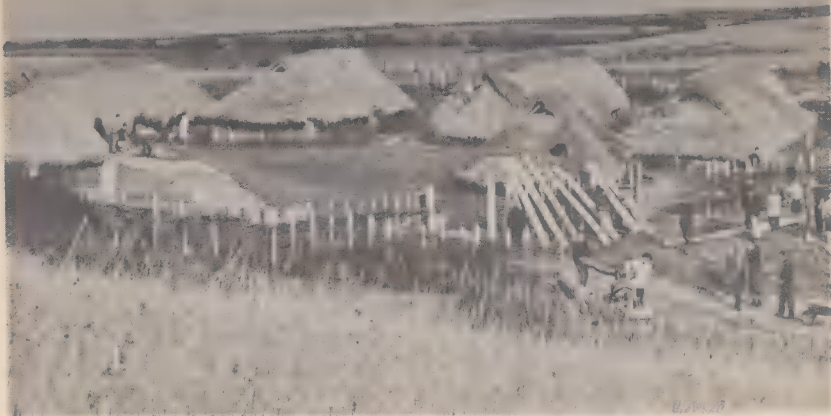
**6. Weaving.** Using old looms and following what are believed to be the ancient weaving methods, the center has discovered that the ancients were extremely good craftsmen. More important in this instance, students and visitors are able to gain a sense of what it must have been like to live in this period and to be forced to rely on cumbersome manual techniques in producing cloth.

**7. Pottery-making.** The ancient methods of pottery-making are all constantly practiced at the center. Carrying out the plan of cultivating "living history," potters work in the village as examples of ancient craftsmen. Students and visitors learn something not only about how pottery was made—but also what it must have been like to be the *potter* himself.

**8. The clay oven.** Archaeologists used to refer contemptuously to a

Hans Ole Hansen builds huts in the style of ancient man and then deliberately burns them down to their very foundations. Below he speaks into a tape recorder to record his observations of a burned hut. The man with a spear is dressed in primitive animal skins as a part of an educational TV film program.





This Iron Age village does not differ greatly from the Stone Age one in building style. Both historical periods used crude sod-roofed huts as living areas. Both of the experimental villages have animal herds, cultivated fields and skilled artisans, just like the originals.

type of Iron Age clay oven as the "smoke oven." Remnants of these ovens had been found on many occasions, and it was assumed that they performed poorly—after all, they had been built by ignorant Iron Age "savages," reasoned some scientists. But no one had ever actually tested one of the ovens. When one was fired up at the center to find out just what it could do, the results were astounding. Instead of a crude, smokey contraption, the oven proved to be a remarkably efficient piece of equipment that, when properly stoked, gave off little smoke, put out a good deal more heat than an open fire of comparable size and was completely spark-free as well.

**9. How they farmed.** Because the peoples of both the Stone and Iron Age cultures represented by the center's primitive settlements were primarily farmers, no accurate picture of these eras would be possible without a comprehensive analysis of the techniques, crops and implements common to ancient agriculture. Stu-

dents from a variety of Danish schools are doing numerous agricultural experiments, taking advantage of crop and tool data gathered and correlated by archaeologists through both logical deduction and actual excavations of ancient farming sites.

The center has tilled fields with stone and wood plows (of the Hama type), sowed unimproved strains of wheat, barley and millet (closely resembling those varieties that once grew wild in Denmark) and harvested crops with crude flint sythes—just as ancient farmers must have done. It's no longer necessary to merely theorize about the problems that ancient man must have had to face in scratching out a living from the land—archaeologists at the center now know first hand what the ancients had to face.

**10. Their farm animals.** The center keeps an assortment of sheep, cattle and pigs at the village. These animals are all raised under primitive farming conditions, and they are all species either identical to or very

much like the breeds that roamed wild in Scandinavia in ancient times.

There are no surviving breeds of ancient pigs—so scientists had to try breeding their own “primitive” pigs. They cross-bred modern swine and wild boars to come up with a breed quite similar to the kind that ancient man must have raised.

**11. Wool and hides.** In conjunction with the live animal studies, investigators are also looking into the ways in which primitive peoples utilized various animal byproducts, such as wool and hides. Materials obtained from the center’s animal population are often used to make replicas of primitive clothing items, and the skeletons are periodically checked against Stone and Iron Age museum specimens, to determine just how closely the physical characteristics of the center’s animals parallel those of ancient livestock.

**12. Ancient man himself.** Archaeology studies the *remnants* of past cultures—the tools, weapons, art work and other relics that survive the ages. But how often does science have a chance to observe the dead man himself—brought back to life, in a way, by the persons who spend months living in his environment?

Students and scientists have learned what it’s like to wear rough animal skins, to go without shoes in the cold spring mud, to tend the animal herds and to harvest the meager crops produced by hard work and primitive tools. This, more than any other discovery about ancient man, is the most revealing.

The Historical Archaeological Experimental Center is located not far from Copenhagen, Denmark, on a 75-acre tract of rolling green farmland near the little village of Lejre.

The money for the project came from the Carlsberg Foundation, set up in the 19th century by J. C. Jacobsen, who among other things, brewed Carlsberg Beer.

Hansen was able to get the backing from the Carlsberg Foundation largely because of the support he received from two noted Danish archaeologists: Prof. P. V. Glob, director of the Danish National Museum, and Axel Steensberg of the Danish Academy of Sciences and Letters. Even though Hansen was just a graduate student at the time, he was able to excite the interest of these two important scientists mainly on the strength of their own intense interest in the principle of imitative experimentation.

### **Support and acceptance come**

In the beginning, much of the Danish archaeological community was skeptical of the project despite the support of the Carlsberg Foundation, Glob and Steensberg. But in the past few years the large majority of Denmark’s archaeologists now sympathize with the aims and activities of the center. The general public, too, has given the center its support. Last year over 50,000 people from all over the world flocked to see ancient history brought back to life in a fascinating 75-acre test tube.

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### **For further reading**

The Dawn of European Civilization. Gordon Childe. London 1948.

Denmark in History. J.H.S. Birch. London 1938.

A History of Denmark. J. Danstrup. Copenhagen 1949.



# The weird things that happen when planes and birds collide

by Henry Lansford

**T**HE PLANE landed on three engines. Its wing was pockmarked with holes and the fuselage was covered with blood . . . . Holes in the wing were up to 10 inches wide. The cowlings on all four engines were dented. So were parts of the wing."

A military aircraft returning from a combat mission? No, this quotation from a wire-service story that appeared in *The Denver Post* not long ago describes a DC-6 airliner that hit a flight of geese at 9,500 feet over

Michigan. The crew and 58 passengers were lucky; nobody was hurt.

Dr. Warren L. Flock of the University of Colorado can tell you about some collisions between birds and aircraft in which pilots and passengers were not so lucky. Dr. Flock, a professor of electrical engineering, is one of many scientists seeking solutions to this growing problem.

"Fatalities and considerable damage have resulted from collisions between birds and aircraft," Dr. Flock says. "An astronaut was killed while piloting a plane in Texas. A commercial aircraft crashed on takeoff in Boston, and another airliner crashed in Maryland after colliding with a whistling swan."

The Boston crash occurred in 1960, when an Electra with 72 persons aboard flew into a flock of starlings just after it lifted off the runway. The bodies of the birds choked the Electra's engines, and it crashed, killing 62 persons and seriously injuring nine.

In 1962, a Viscount airliner, carrying 13 passengers and a crew of four, flew into a flock of whistling swans while cruising over Maryland at 6,000 feet. The horizontal stabilizer hit one of the big birds, and the plane went out of control and crashed, killing everyone aboard.

In addition to taking lives, collisions with birds run up enormous re-



pair bills. Dr. Flock points out that the U.S. Air Force spends about \$10 million every year repairing aircraft damaged by birds.

"In 1965," he says, "bird strikes required the replacement of 75 jet engines costing to \$130,000 each."

Dr. Flock, an electrical engineer by profession and a birdwatcher by avocation, is working to develop radar techniques that federal air controllers can use to steer pilots away from large flights of birds.

"We've established the ability of radar to detect flying birds," he says, "although many persons, including some involved with operating radar systems, are quite unaware of this capability. Most radar operators aren't interested in birds, so they haven't been expecting to see bird echoes. It's necessary to know how to look for bird echoes, which may not be at all obvious in normal operations."

After thinking about the bird-plane problem for some time, Dr. Flock began experimenting in the spring of 1967. The Federal Aviation Administration (FAA) cooperated by allowing Dr. Flock to work with its facilities at the Traffic Control Center in Longmont, Colo., and at other locations. His current study program is supported by a grant from the Air Force Office of Scientific Research.

Using the FAA air route radar, Dr. Flock has concentrated on tracking bird movements in the Central Flyway, a migration route that takes birds between Canada and the Gulf of Mexico over the Great Plains.

By making time-exposure photographs of radar screens, he has worked out techniques for recognizing and recording bird echoes on the radar. He has followed bird movements over eastern Wyoming, western Nebraska and other areas surveyed by the network of radar stations that feed their signals to the Longmont center.

Collisions between birds and aircraft are most common in coastal areas, where waterfowl are plentiful, and along routes of seasonal bird migration such as the Central Flyway. The Denver area, far from the coasts and away from the major flyways, is not much troubled with bird-aircraft collisions.

The FAA's Denver Area Office reports it has known of only two bird strikes in this vicinity in the past seven years. The first involved a duck which collided with a Cessna 210 and tore a hole in the leading edge of the wing as it approached the Jefferson County Airport. The other involved a small bird which broke through the windshield of a Stinson flying at 14,000 feet over Rollins Pass. Both aircraft landed without further incident.

Fortunately, crashes like the ones in Boston and Maryland also are fairly uncommon, and your chances of becoming a statistic in bird strike incidents are extremely slim.

In the first place, most commercial

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airliners now cruise well above the altitudes at which most birds fly. Second, multi-engine airliners can keep flying even if one engine is knocked out. And finally, at present cruising speeds most parts of an airplane, including the windshield, will withstand the impact from one or several small birds. The greatest danger is from large birds, like the whistling swan, or from large flocks of small birds, like the starlings that caused the 1960 Boston crash. And the period of greatest danger is during takeoff, when the aircraft is most likely to encounter birds and is most vulnerable to their effects.

But if you're a military pilot, flying single-engine jets at low altitudes and high speeds, the odds are not so good. At one Air Force base in Texas, two pilots were killed in separate bird strikes in barely over a year. The first died in October 1966 when his T-37 hit a sandhill crane. The second was killed the next October in a collision between his T-38 and a large unidentified bird.

In two years, the Royal Canadian Air Force lost seven F-104 Starfighters to bird strikes. All seven pilots were saved by an efficient ejection-seat system, but the Starfighters, worth about \$1.5 million apiece, were demolished.

Most attacks on the problem of bird-aircraft collisions fall under one of three headings: elimination, manipulation, or accommodation. These three approaches range from one extreme to the other in their regard for ecology, the science which studies nature's communities of plants and animals as complex systems of interacting elements.

Elimination is sometimes referred to by its practitioners as "direct con-

trol," which is a brisk and tidy euphemism for slaughtering birds. In addition to being repugnant to ornithologists as well as most people of average moral sensitivity, this method is not nearly as simple as it may seem. Large bird populations have a way of expanding or rearranging themselves very promptly to fill the vacuum that is created when a few hundred or a few thousand birds are killed off. Thus direct control doesn't work very well unless an entire species is controlled into extinction. Even then, the vacuum will probably be filled by birds of another species.

### **Manipulate or accommodate?**

Manipulation of bird habitats around airfields is sounder ecologically than direct control, but it is far from a perfect solution. In its simplest form, habitat manipulation is practiced by the farmer who puts a scarecrow in his cornfield. Efforts at habitat manipulation around airfields have ranged from putting out noise-makers to bulldozing hills and black-topping nesting areas.

Accommodation, the third approach, is by far the most attractive to those who believe that man ought to be able to use his scientific knowledge and technological skill to achieve harmony with the natural world rather than to attack it head-on. Its basic premise is fairly simple: birds, like high mountains and thunderstorms, are indeed a hazard to aircraft. But since it is probably unfeasible and certainly unwise to eliminate this hazard entirely, why not concentrate on learning when to expect it and how to avoid it?

Advocates of this approach point out that airport planners wouldn't



choose a site with a mountain at the end of the main runway. Shouldn't we give equally serious consideration, they ask, to avoiding nesting areas and feeding grounds and flyways? Our weather services and air controllers work very hard to locate thunderstorms and to help pilots avoid them; isn't it sensible to try to do the same for large flocks of birds?

One of the most heavy-handed efforts to control bird-aircraft collisions is the running battle that has gone on for more than a quarter-century between the U.S. Navy and several hundred thousand albatrosses that nest on Midway Atoll in the Pacific.

The albatrosses were there first, and they were not greatly disturbed by the construction of a Navy airfield on the island just before World War II. Nor were they much bothered by the war itself or by the big airplanes that have arrived and departed frequently ever since. But the albatrosses—gooney birds to the Navy men—very definitely bother the airplanes.

Between 300 and 400 aircraft collide with albatrosses at Midway every year. One out of five of these aircraft either abandons the takeoff or jettisons fuel and lands again to inspect the damage. The damage is often substantial as a full-grown gooney bird has a wingspan of seven feet and is heavy enough to smash a radome or demolish a propeller.

The Navy first tried direct control. During the spring of 1957, more than 6,000 albatrosses were "removed" (another tidy euphemism). The next year 4,000 more were killed. But by 1962 the albatross population in the area enclosed by the runways had increased again to



Seriously damaged wing of this airplane was result of a collision between several sandhill cranes and the plane. Luckily for pilot and crew of the aircraft, a safe landing was made and no one was hurt. But not all such incidents end that well. Many are even disastrous.

more than 1,000 breeding pairs.

Dr. Lorus J. Milne, writer and professor of zoology at the University of New Hampshire, has pointed out that the Midway albatross population is estimated to include more than a third of the world's Laysan albatrosses and a sixth of the black-footed species. Thus a successful effort at direct control on Midway could help send these two species the way of the Steller's albatross, which has been extinct since 1933.

After strong protests were made by conservationists and the public, the Navy turned to habitat manipulation. A task force of Seabees chopped away dunes that produced updrafts used by the gooneys for soaring and blacktopped nesting areas all around the airfield.

At the same time, more Seabees with bulldozers landed on Green Island, 70 miles west of Midway. They leveled off 16 landing strips for the gooney birds, which are notorious for their unskillful and graceless landings. But when the breeding season arrived, the gooneys ignored

Green Island and flocked back to Midway as usual. And an average of one out of every 100 aircraft flying from Midway continued to hit an albatross on takeoff or landing.

The U.S. Air Force found that most bird-aircraft collisions happen on the airfield or within a mile of the runway. Thus the Air Force feels that intelligent manipulation of bird habitats around airfields may be an important part of a solution.

For more than eight years, the Air Force Office of Scientific Research has sponsored a continuing study by Dr. William J. Hamilton III, of the University of California at Davis. On the theory that the key to habitat manipulation is an understanding of bird behavior, Dr. Hamilton and his graduate students are studying the flocking, travel, roosting, feeding and other activities of the starling.

The AFOSR is also supporting CU's Dr. Flock in his study, which is based on accommodating to the hazards of bird movements. Other groups are also working with radar techniques for tracking birds. A group at Johns Hopkins has experimented with distinguishing between radar echoes from different kinds of birds. The Weather Bureau, in the spring of 1968, used its meteorological radar stations to study the migratory habits of whistling swans. And radar is the key element of Operation Birdtrack, a bird warning system being tested by the Royal Canadian Air Force.

After losing several million dollars worth of Starfighters to bird strikes, the RCAF assembled a group of biologists, meteorologists and radar specialists to attack the problem. This group observes bird movements on radar screens, using techniques simi-

lar to Dr. Flock's to show the indistinct bird echoes as recognizable patterns. Then the group uses its collective knowledge of bird migration habits in relation to weather conditions to forecast the birds' movements several hours in advance.

According to RCAF Squadron Leader G.W. Ovans, "The first attempt to provide operators with local bird movement warnings and forecasts was made at the Canadian Forces Base at Cold Lake, Alberta. In that it was our first attempt, the results were encouraging."

The official report on the 1966 pilot project expresses cautious optimism. It says that "there does not seem to be any reason why, given improved tools, techniques and training, a specialized team could not achieve much higher accuracy and really worthwhile results."

It is quite conceivable that, given sufficient time, money and motivation, the advocates of "direct control" could solve the bird-aircraft problem by eliminating all the starlings, whistling swans and other feathered hazards from the face of the earth. Man has a natural talent for this kind of solution. Without even trying, we have gotten rid of the passenger pigeon, the Steller's albatross and other species.

A wiser solution will result if we work toward accommodating to the hazards of birds. As with so many problems involving man and nature, the fundamental question seems to be not "what *can* we do" so much as "what *should* we do."

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#### For further reading

*Fowled Air.* FAA Aviation News. *Federal Aviation Administration.* March 1968, page 8.

# Is yours the special kind of mind that has to know...

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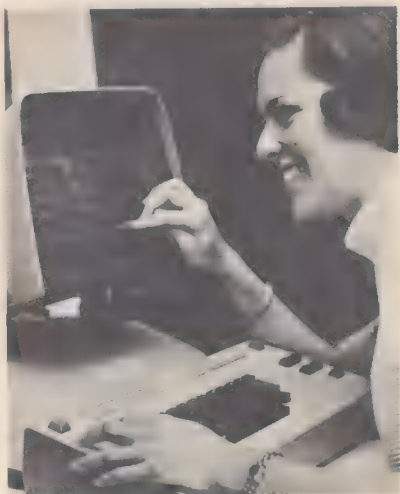
WSD9E1



## Diagnosing disease by computer

**W**HEN A NEW PATIENT enters the Institute of Living, a psychiatric hospital in Hartford, Conn., his case history goes not into a file, but into a UNIVAC 494 computer. The unique system, which is operated by TravCom, Inc., promptly comes up with a diagnosis and prescribes treatment. To keep the machine abreast of the patient's condition, nurses feed data into it at the end of every shift.

Retrieval of the information makes the old system of files and charts look cumbersome. A doctor, nurse or administrator simply requests information from the computer and it appears immediately on a TV-like screen. The data includes the patient's state of health at any point, his medication, comparisons of him with the "norm" and his financial history. The machine will even predict the course the disease is likely to run and the drugs that will probably be most successful in treating it.



Patient profile produced by computer is all part of a new information system being tested at the Institute of Living in Hartford, Connecticut. Data is fed into computer, which diagnoses the disease and stores the information.

Sometimes UNIVAC comes up with a surprise. A recent group of patients admitted to the Institute were diagnosed by the computer as schizophrenics of one type or another and the appropriate treatment prescribed. The patients showed unquestioned improvement under the computer-dictated regimen. At this point, someone discovered that the patients' problems before admission had been alcoholism, not schizophrenia.

"But the schizophrenia treatment is working; the patients are doing fine," says Dr. Bernard C. Glueck, Jr., the Institute's director of research. "There's hope that we're on the trail of a whole new approach to

alcoholism. It's a classic example of the job a computer can do in sorting out symptoms that doctors have been missing for years."

The computer can do the job simply because it can record, recall and correlate more information about patients than was ever possible before, he points out. And it can do it at top speed. Some 7,000 deformed babies were born before medical laboratories were able to put the blame on the drug thalidomide. Medical computers programmed with a system like that

at the Institute could have isolated thalidomide as the cause by the time the *third* tragic child had been born.

Another advantage to the system is its security, say TravCom officials. Only persons authorized to have access to certain portions of the patients' records can get them from the computer.

"The system is all we hoped it would be, and more," says Dr. John Donnelly, psychiatrist and chief of the Institute. "I don't think we could get along without it now."

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### Another Ice Age?

Is a catastrophic climate change in store for the world within a few decades?

Polar explorer Bernt Balchen, the man who flew Admiral Byrd to the South Pole in the 1920s, thinks such a climate change may occur as a result of the disappearance of the Arctic ice pack, an event he foresees happening in the 1970s. The ice is steadily thinning, he maintains, citing reports on ice thickness going back to 1893. If the ice does disappear, a number of experts think it wouldn't reform again.

The result of an ice-free Arctic Ocean might well bring on the climate changes Balchen predicts. The northern ice cover is a region of high pressure that deflects storm paths to the south. If the ice cover did not exist, storms might move north, depriving the central United States and central Eurasia of rainfall they need to produce crops. But the winds blowing off the Arctic Ocean would become moist, producing almost constant snowfall on the mountains in the path of the winds.

This constant northern snowfall would begin the formation of new giant ice sheets like those that once moved south across North America and Eurasia.

Don't start planning to move to the southern hemisphere yet. Most experts think Balchen's fears are exaggerated. Dr. Norbert Untersteiner of the University of Washington notes that the Arctic ice varies widely in thickness depending on season and location. In the central Arctic, it's many yards thick but between ice floes it may measure only a few inches. About a quarter of the pack melts each summer.

Consensus among polar specialists is that the trend is towards cooling, not warming, in recent years. Joseph O. Fletcher cites the recent appearance of pack ice around Iceland again to confirm the cooling temperatures.

A number of specialists agree with Balchen, however, that the ice cover of the Arctic Ocean is "vulnerable." A moderate increase in solar heat, or a change in the transparency of the atmosphere could melt the ice. Since

the Arctic ice floats on water, the melting would not raise the level of the world's seas because floating ice displaces as much water as the water produced when the ice melts.

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### Physics for girls only

Girls traditionally shy away from the field of physics, but a Moline, Illinois, high school has been having success with an all-girl physics class they started two years ago. This year, physics enrollment is up 58 percent for the school as a whole. The girls perform experiments to find basic principles, using mathematics only to develop the results of their observations. Girls and boys are segregated in separate classes because when a boy and girl are paired as partners for a lab experiment, the girl invariably assumes what she thinks of as her proper role as a spectator.

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### Chinese food mystery solved

The "Chinese Restaurant Syndrome" experienced by some persons after eating Chinese food is due to a

normal response to monosodium L-glutamate (MSG), a widely-used food additive. A report in *Science* describes how a team from the Albert Einstein College of Medicine fed susceptible subjects each of the ingredients in the popular Chinese wonton soup. Only MSG provoked symptoms—burning sensations, facial pressure, chest pain. When a large number of normal subjects ate MSG, all but one developed the same symptoms. Why does Chinese soup in particular bring on the syndrome? The research team points out that prior ingestion of food protects individuals from the effects of MSG but that soup, which contains large amounts of the substance, is normally eaten first.

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### Spreading primordial ooze

The age of rock samples from the underwater Mid-Atlantic Ridge supports the controversial theory of "continental drift," but as the rocks tell it, it's more like middle-ocean spread.

General Electric scientists recently

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France's SST, the Concorde 001, touches down following its 29-minute maiden flight at Toulouse. The brake parachute billows from the tail of the second supersonic plane to fly, and the adjustable nose droops on landing to give the pilot unimpeded vision for the big touchdown.

Pictorial Parade





dated four samples of rock from the ridge that have been dredged up by a Geological Survey of Canada expedition. The rock from the center of the valley separating the two ridges that form the Mid-Atlantic Ridge is comparatively young—about 13,000 years old. Four miles away from the center, the rock is 290,000 years old. Rock samples from 10 and 36 miles away are 740,000 and 8,000,000 years old, respectively.

The distribution of ages is consistent with the theory that the ocean floor is spreading out on both sides from the Mid-Atlantic Ridge. The rock in the center would be new magma forced up through the rift surface at the site of the ridge by convection currents deep within the earth. As the new rock appears, it thrusts the old rock farther and farther away. At the same time, the spreading floor slowly drives the continents apart.

The spreading of the ocean is not ■ cause for immediate alarm. It's estimated that the outward movement is taking place at the rate of just one inch a year.

### Health hints for exotic pets

Where do you inoculate a turtle? What can you feed a finicky snake? Does ■ monkey need vitamins?

Americans are buying more and more exotic pets, but as yet few American veterinarians know how to deal with them. One who does is James C. Rousch, D.V.M., an animal surgeon at Manhattan's Animal Medical Center. He counts monkeys, wildcats, kinkajous, coatimundis, weasels, crocodiles, snakes and other strange creatures among his regular



Cancer can spread wildly, and it travels much like an earthworm, according to a research team at the Chester Beatty Institute in London. This photograph shows how the cancer cell grips a millipore filter. Normal, healthy cells stick to each other, and not to the filter.

patients. Here's some of his advice from the *Friskies Research Digest*:

**Monkeys:** Simians usually need vitamins and minerals to prevent a crippling ailment known as simian bone disease that results in broken or malformed limbs. Most susceptible are the attractive little South American species—Wooly, Capuchin, Spider, Squirrel—often seen in pet shops. It's a good idea, too, to check monkeys yearly for tuberculosis.

**Wildcats:** These cats also are susceptible to simian bone disease—actually secondary nutritional hyperparathyroidism—and it's usually due to an all-meat diet low in calcium. The prescription: vitamins and minerals. Young wildcats often develop feline enteritis, an inflammation of the intestines, but they can, and should, be vaccinated against it.

**Turtles:** Abscesses and tumors are common in turtles. Dr. Rousch rec-

ommends cutting out the masses and closing the incision with fine stainless steel wire. Postoperative treatment calls for antibiotics, injected in the loose skin just behind the turtle's hind leg. Old turtles (and old crocodiles, too) sometimes get chronic nephritis, a kidney inflammation, that requires a low-nitrogen diet and fluid injections.

Snakes: Captive snakes may refuse to eat. You can maintain them with injections but eventually they'll lose weight and develop wrinkles. To revive their interest in food, try lubricated chicken hearts stuffed with bone meal; you'll have to push them gently down the snake's throat. Snakes get colds frequently, too; one treatment is injections of diluted tetracycline.

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### Up-tight dogs

Tense, nervous breeds of dogs have been found to have abnormally high amounts of magnesium and manganese in their spinal fluid, says Dr. James O. Wear of the Omaha Veterans Administration Hospital. He analyzed the cerebrospinal fluid from the backbones and brains of eight purebred pointers bred for nervousness. The dogs were so sensitive that a noise made them freeze for periods up to an hour. When small amounts of the fluid from nervous dogs were exchanged with fluid from normal dogs, the normal animals developed temporary nervous characteristics. Normal fluid had no effect on nervous dogs. "The difference in magnesium and manganese levels must be due to a difference in metabolism of the two strains, since their intake of trace metals should be the same,"

says Dr. Wear. Whether or not human nervous disorders can be treated by adjusting levels of these metals in people isn't known.

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### King Henry "the Punchy"

Henry VIII has been maligned. True, he did lop off the heads of a few wives, but he didn't have syphilis, according to a London doctor. Henry's erratic behavior in later years stemmed from his athletic activities, particularly jousting, says Dr. Norman Barrett of St. Thomas' Hospital, London. Neither Henry's mistresses nor his children exhibited syphilis, and Henry never showed the insanity characteristic of the late stages of the disease. Henry *did* joust regularly for 20 years and was hurt a number of times. After one incident in 1536, his character changed completely, possibly because of brain injuries similar to those suffered by prize fighters of today. Henry wasn't insane, according to Dr. Barrett. He was just "punchy."

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### St. Peter's Throne isn't

The throne of St. Peter in St. Peter's Basilica in Rome isn't old enough to have been used by the first-century saint, carbon 14 dating shows. Tests on the wood and ivory throne conducted at Rome University indicate that the wood dates from several centuries after the birth of Christ. The amount of carbon 14 in a once-living organism—in this case the wood—indicates when the organism died. Meanwhile, the throne, encased in bronze, remains above the altar in the apse of the Basilica.

## SCIENCE DIGEST SPECIAL



## SATELLITE weather forecasting

Today's orbiting craft are providing a sky-high look at the weather that helps meteorologists track storms and spot fog and snow. Tomorrow, satellites may make three-week weather forecasts a reality.

by Barbara O'Connell

**T**WO OR THREE TIMES a day, a facsimile machine in the Federal Government's Environmental Science Services Administration building in Suitland, Maryland, whirs gently and out pop several 8 x 10 black

and white photographs, each showing an area of the earth's surface some 4,000,000 square miles in extent. One picture covers eastern Canada, the eastern United States and northeastern South America; the next displays the western half of the continents. The photographs are

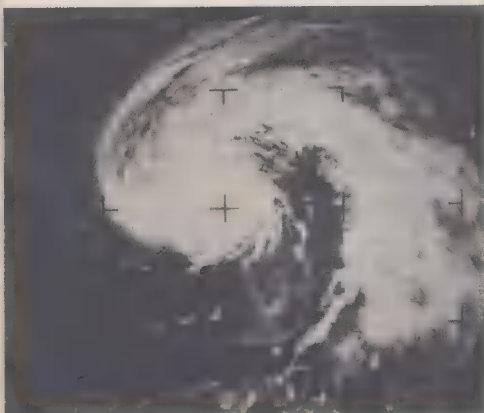


coming directly into the facsimile machine from a special camera in a weather satellite passing over Suitland at a height of some 700 miles. They were snapped just minutes before.

During the same 24-hour period, picture data from another weather satellite is coming into Suitland by wire from stations in Fairbanks, Alaska and Wallops Island, Virginia. These picture signals, which cover the entire globe, are displayed

on a kinescope one line at a time, then photographed. A high-speed computer processes the individual photographs into a mosaic picture that shows weather patterns of the entire globe.

Day in and day out, the picture taking process continues; since U.S. weather satellites began snapping pictures in earnest back in 1960, more than 1,100,000 photographs of the world's weather have been taken and transmitted back to earth.



Hurricane Alma of 1966 is plainly visible in this portion of a photograph snapped by NASA's Nimbus 2 satellite over Florida. Nimbus tracked the storm for six days. The degree of banding in the hurricane's spiral lets meteorologists estimate speed of its winds.

Satellites spot fog, (below left) in this ESSA shot of western United States. Fog in California's Sacramento and San Joaquin Valleys appears as long, blurry white blob running parallel to coast. Latitude-longitude lines and land outlines are supplied by the computer.



Every time APT satellites pass over John B. Tuke's home in Stranraer, Scotland, he receives a photograph of the local weather conditions on his home-built photo recorder. About 400 APT stations exist across the world; most are operated by weather stations.



You've probably seen some of these pictures on your local news show and been able to pick out such easy-to-identify features as the tight coil of a tropical storm. A trained meteorologist can do far more. Given a good photograph, he can pick out an ice-covered lake as small as two miles in extent or a burgeoning storm system too small to be spotted from the surface of the earth. In the comparatively brief time that weather satellite data has been available, it's become a useful aid to surface observations; in the future, most weathermen think, it will be invaluable.

Essentially, four kinds of weather satellites are responsible for this new kind of weather information. The Environmental Science Services Administration—mercifully shortened to ESSA—has five small wheel-shaped satellites spinning around the earth at present, the last of which was sent into orbit on February 29 of this year. Three of these craft have a camera system referred to as APT (Automatic Picture Transmission) that provides local photographs to some 400 ground stations all over the world; the other two craft incorporate a delayed picture system called AVCS (Advanced Videcon Camera System) in which picture data is stored aboard, read out to ground stations, then transmitted to Suitland. ESSA, in turn, provides the data to weather stations across the country. Later this year, ESSA will orbit a bigger satellite called M-ITOS that's shaped like an egg carton with wings and will contain *both* cameras in a single craft, plus a number of other sensors.

Before ESSA puts a satellite into orbit, its instrumental load is thor-

oughly tested on research weather craft operated by NASA's Goddard Space Flight Center at Greenbelt, Maryland. NASA expects to have its newest research satellite, Nimbus 4, in orbit some time this spring. The craft, which will fly some 600 miles above the earth, replaces Nimbus 3, which plunged into the Pacific Ocean last spring as it was being launched. It's the first launch failure in the weather satellite program. The predecessor of Nimbus 3, Nimbus 2, remained aloft for over two years, snapping high-resolution infrared photographs of the nighttime world as well as daylight photographs.

### **Two 'stay-putnics'**

There's another NASA satellite, too, the ATS (Applied Technology Satellite) that orbits the earth at 23,000 miles in such perfect synchronization with the earth's rotational speed that it is always at a fixed point above the globe. Referred to as the "stay-putnics," the two ATS satellites have a number of chores, one of which is weather photography. As yet, they're the only weather satellites to snap color photographs of the earth.

Together, these four kinds of satellites can already provide meteorologists with a look at the world's weather that makes up in sheer quantity what it lacks in quality. A satellite orbiting the earth at 600, 700 or 23,000 miles obviously can't provide the kind of detail available from direct sensors on the ground or in aircraft or balloons. But remote sensors in satellites can provide an incomparable overall view of the earth, including a number of areas which meteorologists ordinarily

never see. Only 20 percent of the world's surface, it's estimated, is covered by direct observations; weather satellites can scan the entire globe in a single day.

"What the remote sensor lacks in precision at a point, it usually makes up for in sampling density in both space and time," David Atlas of the Department of Geophysical Sciences at the University of Chicago told the American Meteorological Society recently. The accuracy obtainable with satellite sensors, he added, "may be equivalent to that of a very large number of direct measurements."

### **Pictures tell the story**

What, exactly, *can* weather satellites do at this early stage in their history? Until now, the weather information provided by the ESSA craft, ATS, and even the advanced Nimbus 2 has consisted almost entirely of pictures—day and night photographs of the earth's surface and cloud cover. But a trained meteorologist can do amazing things with pictures. At Kennedy Airport in New York, for example, weather personnel annotate photos from the airport's own APT facility to show pilots the location of storms, the jet stream, fog, snow and clear weather, among other weather systems. A typical map may show a storm center off the east coast of the U.S., snow further inland and clear weather over the mid-Atlantic and Caribbean. Information like this is particularly helpful to pilots flying transocean routes where little surface information is available.

Current satellite photographs have a number of oceanographic applications, too. Ice-forecasting centers in

the North Atlantic use them to determine the extent of the sea ice and the stage of its formation or breakup. By noting the movement of the ice in consecutive photos, meteorologists can even track ocean currents. They can also make a rough estimate of the state of surface waters in a sunlit photograph; the size and brightness of the glint in the picture correspond to the roughness of the water. The infrared sensors aboard the Nimbus craft come in handy, too, to map sea surface temperatures.

On land, satellite data is used to spot snow cover and its depth, an important task in the western U.S., where snow run-off is a potential water source. Snow spotting is tricky, though; you have to know the terrain, because snow on a Nebraska stubblefield looks entirely different than snow in a Colorado forest. In a non-forested area, a meteorologist should be able to fix the snow boundary with a plus or minus accuracy of ten miles and estimate its depth by measuring the comparative brightness of the white area. He can do much the same for ice on inland waters. Satellite data has also been used to locate moist areas in the Middle East for locust control programs. The moist areas, as might be expected, appear darker in satellite photographs.

Sometimes even the best-trained meteorologists go astray in interpreting satellite data. In the early days of satellite photography, weathermen at

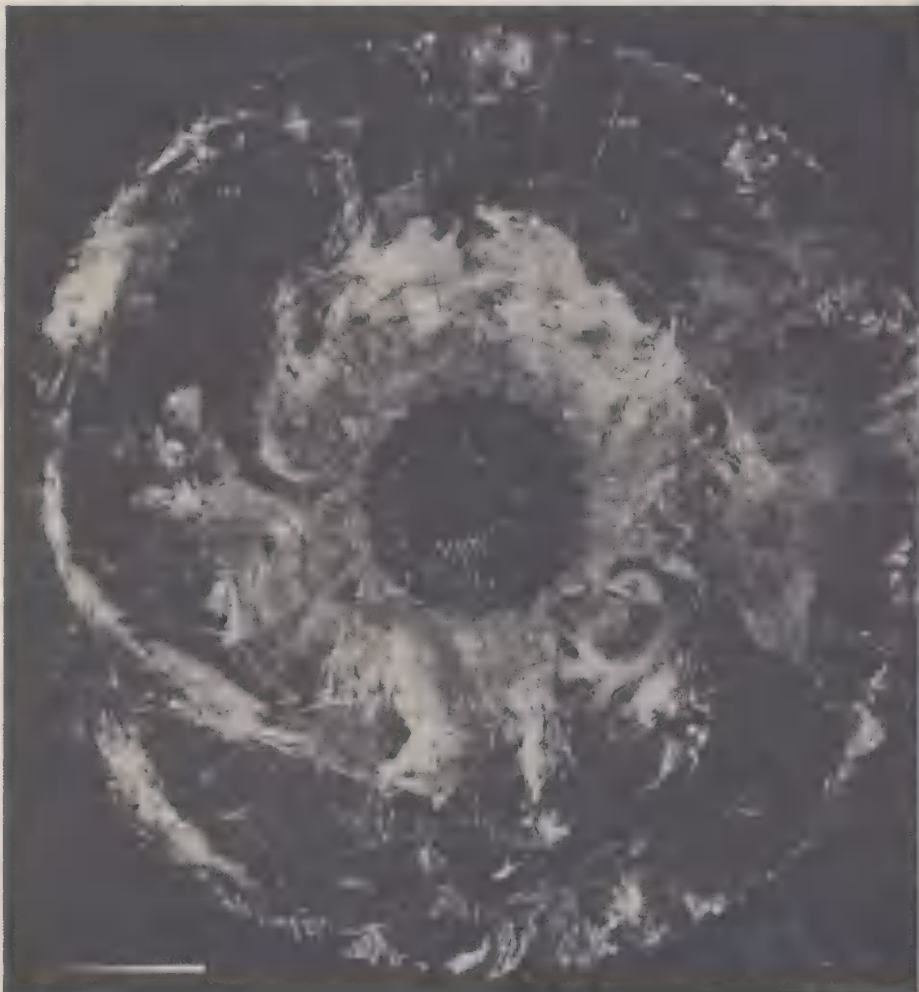
High-speed computers process weather satellite data into daily mosaics that show weather patterns over the entire globe. ESSA 7's Advanced Videcon Camera System took the photographs to produce this view of the cloud-covered northern hemisphere January 26, 1969.

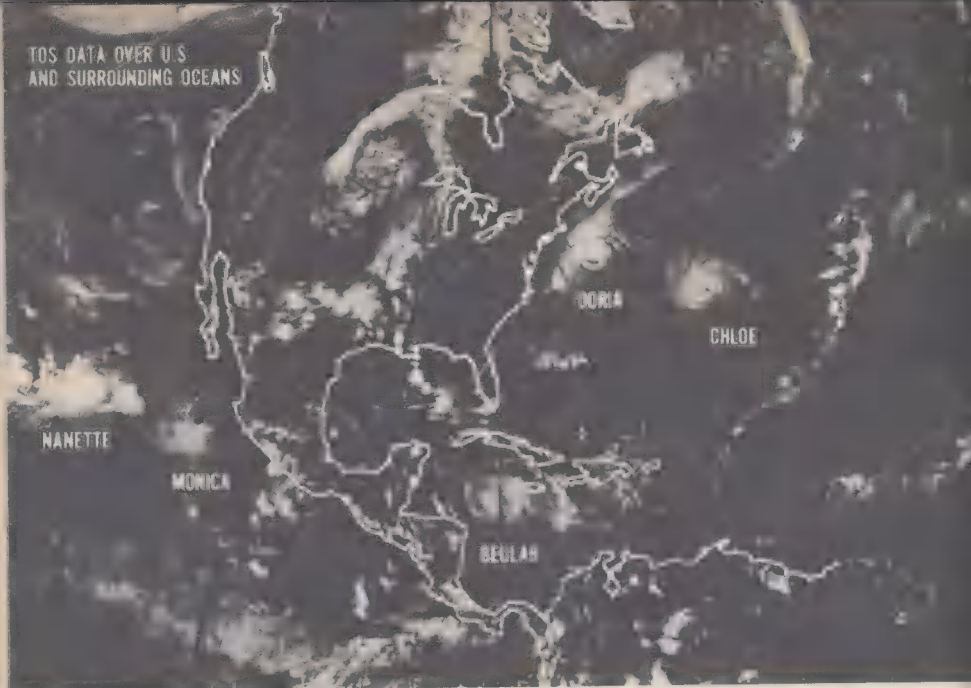


ESSA's Suitland base referred to a small bright spot in the southwestern United States as a cloud. Mysteriously, however, the "cloud" persisted for month after month in the same place. Eventually, it was identified as White Sands, New Mexico, now recognized as the brightest spot in the U.S.

The most dramatic use for

weather satellite data until now has been in predicting violent tropical storms. "In the past five or six years," says Arthur W. Johnson of ESSA, "no major tropical storms have arrived by surprise due to satellite photographs." Tropical storms often form in remote areas and by the time they reach a populated area and are spotted, they're major dis-





No less than five hurricanes raging over a third of the earth's surface are shown on this satellite photo map (above) compiled from pictures taken on September 14, 1967, by ESSA 5. On Nimbus infrared view of the nighttime weather (left) taken by HRIR sensor, Great Lakes are warmer than the land and appear darker in color; clouds are colder than land or water and appear much lighter.

turbances. A ship or aircraft can easily miss the early stages of a hurricane or a typhoon in the far reaches of the ocean, but the satellite's global view immediately identifies the suspicious system. Hurricanes and typhoons have a distinctive coiled pattern that's easy to spot on a satellite photo, even in the early stages. Last October, two ESSA satellites made it possible to keep a close watch on Hurricane Gladys long before it reached the Florida Coast. In September 1967, ESSA 3 located young Typhoon Opal, then some 1,000 miles southeast of Japan.

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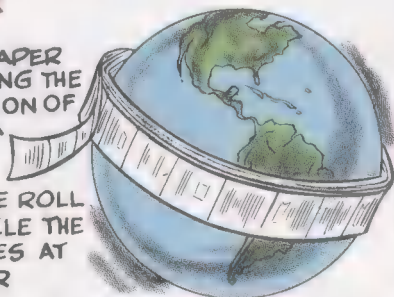


# STRANGE as it seems by ELSIE HIX



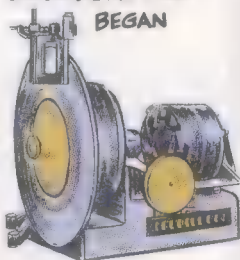
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coil, or spiral, and the degree of overcast, meteorologists can even predict the speed of wind in a hurricane or typhoon to within 20 knots. Twenty knots, as one meteorologist points out, doesn't make much difference when the wind is roaring at hurricane speeds of 150 knots or so an hour.

One of the most interesting future uses of weather satellite pictures may be in the prediction of tornados, the violent storms that tear out of the Midwest with little or no warning in the spring and fall. Vincent Oliver of ESSA's applications section thinks satellite photos will "definitely" provide an indication of systems that might develop into tornados. Tornados present two difficulties to the weather forecaster: they arise very quickly and they are usually buried in such a mass of clouds that it's impossible to detect the funnel-shaped tornado cloud in the general overcast. Last spring, however, ESSA borrowed the NASA research ATS satellite to track the development of suspicious systems that did, indeed, develop into destructive tornados. To track the tornado system, ESSA moved the ATS satellite normally stationed over the mouth of the Amazon River westward so that it could photograph the west coast of the United States, Mexico and the adjoining waters of the Pacific. On April 19, the ATS pictures revealed a large mass of moisture flowing across the United States from the West—the Jet Stream. When the Stream reached the Midwest, several tornados occurred. The same phenomenon occurred a few days later on April 23.

Oliver and his colleague, E. W. Ferguson, have put together a movie

of the ATS photographs taken on April 19 and 23 that makes fascinating viewing. The Jet Stream moves across the country, a circulating storm system emerging rapidly as the stream reaches the Midwest. "No one ever knew before how fast these clouds could grow," says Ferguson. "Most of the tornados that occurred from this weather system were north of the Jet Stream and most of the hail was south of it." This spring, the tornado watch is taking place again.

Current weather satellites are a useful supplement to traditional weather observations but their future is what really excites meteorologists. No one talks about long-range weather forecasts without mentioning, sooner or later, the role that weather satellites will play in gathering the enormous amount of data needed for the task.

### ***A fiendish task***

"A fiendishly difficult and challenging problem lies before us—to understand the complex forces that drive the global winds and produce the yet-unpredictable long-term change of weather and climate," notes Walter Orr Roberts of the University Corporation of Atmospheric Research in Boulder, Colorado. "To solve this problem without space satellites of new and sophisticated character is unthinkable. Such satellites, coupled with many other devices, will be required to monitor the world's winds and clouds and to chart the flow of ocean currents."

What is needed to make such long range forecasts a reality, meteorologists explain, is information on wind speeds, on pressures, on moisture, on temperatures, not only from the sur-

face of the earth, but from the various levels of the atmosphere as well. These millions of units of information would be fed into supercomputers perhaps a hundred times more powerful than today's best to come up with a precise long term forecast. How long? Two weeks, possibly three, are the predictions made most frequently. Edward N. Lorenz, a meteorologist at the Massachusetts Institute of Technology, puts three weeks as the ultimate in long-range precision predictions despite any conceivable improvement in weather observation technology. But a three-week precision weather forecast has obvious advantages over today's forecasts. You could plan your family picnic with guaranteed sunshine, your ski trip when there's sure to be plenty of snow. A report by the National Academy of Science and the National Research Council estimates that accurate long-range forecasts could save the U.S. economy more than two million dollars annually.

The box-like M-ITOS gets a checkup from an engineer at RCA's plant near Princeton, N.J., where the new operational satellite was built. It's scheduled for launching this summer.



The equipment on current weather satellites does not measure winds, pressure, moisture or temperature, with a few minor exceptions; they are, as one meteorologist put it, "primarily in the picture taking business." But ESSA's new M-ITOS satellite will carry a number of new sensors tested on Nimbus 1 and 2 that will give local weather forecasters more information about the weather than they've ever had before. One sensor, a radiometer, will provide global measurements of the earth's thermal energy; another, the solar proton monitor, will measure solar proton energy. Information from the infrared sensor that will take nighttime photographs can also be interpreted in terms of temperatures, which should make it possible to infer the heights of cloud tops.

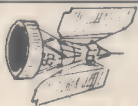
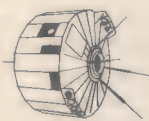

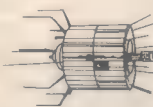
### ***Like a 'massive butterfly'***

A larger package of new remote sensors will be aboard Nimbus 4 when it lifts off this spring. Ten feet tall and weighing almost 1,000 pounds, Nimbus 4 is by far the biggest of the weather satellites launched so far. It's built something like a massive butterfly, with eight-foot-tall solar wings that provide most of the power in flight and a ring-shaped body that contains the various sensors. Here's a rundown on some of them:

An infrared interferometer spectrometer, IRIS, which measures vertical temperature, water vapor and ozone distribution. NASA regards IRIS as a major step forward in achieving effective forecasts from weather satellites.

A satellite infrared spectrometer, SIRS, that will also measure vertical

# WEATHER SATELLITE SCOREBOARD

NAME	SIZE	WEIGHT	CONFIGURATION	ORBITAL HT.	LAUNCH DATE
Nimbus IV (NASA) AVCA/APT cameras	10' x 11'	1200 to 1300 lbs.		690 miles	4-1-69
ESSA II APT VI APT VII AVCS VIII APT IX AVCS	42" x 22.5" 42" x 22.5" 42" x 22.5" 42" x 22.5" 42" x 22.5"	285 lbs. 285 lbs. 320 lbs. 285 lbs. 320 lbs.		865-900 miles 865-900 miles 865-900 miles 865-900 miles 900 miles	2-28-66 11-10-67 8-16-68 12-15-68 2-26-68
M-ITOS (ESSA) AVCS/APT cameras	48" x 40"	675 to 700 lbs.		900 miles	summer '69
ATS (NASA) synchronous orbit; color camera I III	54" x 57.6" 54" x 57.6"	750 lbs. 750 lbs.		22,300 miles 22,300 miles	12-7-66 11-5-67

temperature from earth's surface.

A high resolution infrared radiometer, HRIR, which will take infrared photographs of the earth in darkness. Stored photos from a full orbit will be read out at Goddard and live APT pictures will be received at all APT ground stations.

A medium resolution infrared radiometer, MRIR, which will measure the earth's radiation balance.

An ultraviolet solar energy monitor, MUSE, which will measure the ultraviolet radiation flux from the sun.

An interrogation recording and location system, IRLS, that will locate and determine the position of sensors

on balloons, buoys, aircraft and fixed platforms for relay to a central ground station.

An Image Dissector Camera System, IDCS, that will relay live pictures to APT stations and record pictures of the entire globe for playback to Goddard Space Flight Center. Previous Nimbus and ESSA craft required two cameras to do the job of one IDC. The resolution of IDC is so good that a meteorologist should be able to recognize an island smaller than two miles in length on the photographs it takes.

The sensing devices that prove successful aboard Nimbus 4 will eventually be incorporated into one



of the operational M-ITOS series, which has plenty of room for more sensors aboard future craft.

In addition to gathering information for long-range forecasts, sensors like those aboard Nimbus 4 and M-ITOS could be used for a host of other scientific purposes. Biologists would like to attach small IRLS packages to animals like whales, elephants, polar bears and sea turtles so that satellites could interrogate them to learn more about the creatures' migratory habits. Weather modification experts think that determining cloud top temperatures through infrared sensing may make it possible to select the best clouds for seeding efforts, so that seeding aircraft could be dispatched directly to those areas.

### ***Finding fish by satellite***

Oceanographers hope to locate schools of fish by selecting areas where the food supply and water temperatures are most attractive to fish. Color satellite photographs may help here because investigation shows that the change of ocean water from blue to green usually indicates the presence of organic fish food. Hydrographers and geologists expect weather satellite data to help them chart underwater and ground features. Pictures from an early Nimbus resulted in moving Mount Siple—a 10,000 foot high Antarctic mountain—45 miles to the west. Agriculturists think satellite sensors could make a national forest survey that would indicate types of vegetation observed.

Any program involving global weather necessarily involves the cooperation of a number of nations. Since the early 1960s, the U.S. has

been involved in a program called the World Weather Watch with a number of UN member nations, including the Soviet Union. There is a WWW analysis center in Moscow, others in Washington and Melbourne, Australia. The Russians have a sophisticated weather satellite program of their own although it hasn't yet achieved global coverage. They regularly supply data to us and we, in turn, supply data to them. Several APT stations are known to be operating within the boundaries of the Soviet Union. Another international weather program called GARP—Global Atmospheric Research Program—is fostering major experiments for improving and testing weather satellites in the U.S., the Soviet Union and France. Part of GARP's purpose is to determine just how much information, satellite and otherwise, would have to be put into a computer to give accurate long-range forecasts. By 1976, proposed as a GARP year of intensive observations and analyses, they hope to have an answer.

From here, the forecast for eventual long-term weather predictions and other benefits of weather satellites looks sunny.

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### **For further reading**

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*Nimbus: A Progress Report.* Harry Press and Wilber B. Huston. Astronautics and Aeronautics. March 1968.

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# NEXT: you may control your own heartbeat

by Arthur J. Snider

**E**XPERIMENTAL ANIMALS have been taught to speed up or slow down their heart beats, increase or decrease their blood pressure, retard or quicken stomach or intestinal contractions.

These and other functions, all controlled by the so-called autonomic nervous system, have been regarded as automatic, involuntary functions, independent of the wishes of the organism. But Prof. Neal E. Miller of Rockefeller University believes that these vital life processes can be controlled by voluntary means, as is the central nervous system which is activated by intent.

He has demonstrated it has been possible to teach rats to make one ear blanch and the other blush simultaneously, thus bringing a selected portion of the circulation under voluntary control. This suggests it might one day be possible to increase the blood supply to the heart by voluntary means in patients with coronary artery disease. Learning to control blood flow to specific areas might also be helpful to people with defi-

ciency of blood to the brain.

The animals were taught to control their autonomic function by conditioning. They were hooked up to instruments which continuously measured autonomous nerve function. When the functioning was in



the direction the scientists wished it to take, such as a faster or slower heart beat, or an increase or decrease in mouth watering, the animal was "rewarded." Once taught in repeated daily lessons for a month or more, the "learning" persisted.

"While it is far too early to promise any cures for human psychosomatic disorders, it will certainly be worth while to investigate thoroughly the therapeutic possibilities of improved training techniques," says Prof. Neal.

## Tooth decay beaten for good

A dental authority has relaxed the profession's firm injunction against sugary foods by offering a compromise.

"All the sweets one wishes, but once a day," is suggested by Dr. Paul

H. Keyes of the National Institutes of Dental Health, Bethesda, MD.

Ever mindful of the colossal American sweet tooth, Dr. Keyes says a once-a-day transgression is a "reasonable compromise that many people will accept.

"It is not realistic to expect that patients will eliminate all sweets from their diet," he says.

Each exposure to sweets sets up an acid-producing process that attacks enamel, he explains. By limiting exposure to a single episode, the teeth are subjected to less corrosive assault than if sweets were taken in small amounts but often.

Dr. Keyes' indulgence appears to be born of a confidence that dentistry is rapidly acquiring the tools to control the decay problem, sweets notwithstanding.

Some of the most promising tools are drugs, particularly antibiotics,



since dental decay is now thought to originate as a bacterial infection producing the acid.

"Hundreds of antibiotics are sitting on the shelf and drug companies don't know what to do with them," he says. "The ideal treatment may already be in our hands."

Another promising tool is enzymes. One already has been identified as capable of preventing the formation of plaque, the deposit on the tooth surface that serves as a medium for bacterial growth.

"The enzyme, dextranase, appears to be effective against specific staphylococci decay, but unfortunately the particular staphylococci are only a small part of the problem."

Other weapons in the arsenal are

fluorides and good tooth-brushing habits.

"Children today need not become the dental cripples that many of their parents are," Dr. Keyes says.

He foresees the time when the major service of dentists will be guidance in oral hygiene and minor scaling and polishing of teeth.

---

### Smoking and your heart

It isn't generally appreciated that cigarettes are more harmful to the heart than to the lungs. A two-pack-a-day smoker has four times the risk of a heart attack as a non-smoker, says Dr. Richard C. Bates, a cardiologist of East Lansing, Mich.

"Fortunately," he adds, "the adverse effect of cigarette smoking on the heart is completely reversed six months after stopping the last cigarette."

Unlike cigarettes, pipes and cigars don't shorten life. "All they do is cause cancer of the lip and tongue," he points out. "These cancers are curable if you don't mind giving up a lip and a tongue."

---

### Drugs fight anxiety neurosis

Anxiety neurosis is a condition physicians dislike being confronted with. The patient reports symptoms of smothering, heart palpitation and a feeling of being on the verge of a heart attack.

Repeated physical examinations show no abnormality. Laboratory tests are negative. Doctors usually send their patients away after telling them nothing is wrong or prescribing sedatives. Privately, they say the patients have it "all in their heads" and



refer to them as "crocks"—medical slang for neurotic complainer.

"The high prevalence of the disorder, prompting anxiety neurotics to see physicians frequently, accounts for the fact that between 10 and 30 percent of most general practitioners and internists have patients who are anxiety neurotics," writes Dr. Ferris N. Pitts Jr., of Washington University, St. Louis, in *Scientific American*.

He doubts the belief that anxiety neurosis is truly a neurosis. The basis for his doubt is the ability to produce the symptoms by injecting lactic acid, a normal substance produced in the body during the metabolism of sugar to energy. Lactic acid commonly rises in the body after exercise.

Fourteen patients who had experienced anxiety neurosis in the past and 10 normal persons were injected with lactic acid and other solutions during a series of experiments. Neither the experimenter nor the patients knew which was which. All 24 identified lactic acid as the solution producing the most symptoms. The probability of this identification happening by chance was one in 10,000.

The mechanism by which lactic acid produces the anxiety symptoms is not clear. Dr. Pitts believes that patients produce a large amount of lactate in response to secretion of adrenalin, one of the hormones secreted by the adrenal glands during periods of physical or emotional stress. He believes they also may have a metabolic defect that results in an overproduction. The condition often runs in families.

Dr. Pitts finds that when calcium is added to the injected lactic acid,

symptoms are markedly reduced.

If it can be confirmed that the anxiety symptoms do indeed have an organic component, the possibility of a drug treatment is opened up. A new drug, propranolol, has been tested in London and South Africa during the last two years and has shown promise in reducing or alleviating anxiety symptoms, he said.

### Obesity starts in childhood

Overfeeding of children in infancy and pre-adolescent years builds up fat cells (adipose tissue) that remain with them a lifetime. Dr. Jules Hirsch, professor and senior physician at Rockefeller University, New



York, says that studies show once these cells are laid down, they never disappear.

When weight is lost, the cells shrink but they continue to function. At times, they may send out metabolic signals, demanding to be refilled. This demand may account for the fact that so many people find it difficult to keep their weight down after dieting, Dr. Hirsch says. The constant craving for food may not be wholly psychological, as

many have thought. It may be partly based on a biological need caused by the deprived fat cells.

A lean person has about 27 trillion fat cells in his body. Obese persons, on the other hand, have about 77 trillion. This means that fat people not only have fatter cells but also about three times as many, says Dr. Hirsch.

"The problem of overweight looks more hopeful on the preventive side," says Dr. Hirsch. "This means more attention must be given to dieting and overfeeding in childhood. A chubby baby is not necessarily a healthy baby, yet we see in advertising of baby foods pictures of infants that are clearly obese."

---

### **Disease, Vietnamese Style**

There is no danger of a medical time-bomb or a menacing new Oriental disease being brought back to this country by American forces in Vietnam, even though diseases are hospitalizing troops at a rate three times that of hostile action.

Col. Jerome H. Greenberg of Brooke Army Medical Center, Fort Sam Houston, Texas, says the ailments are well understood and kept under control.

The greatest loss of manpower in Vietnam is due to respiratory, intestinal, skin and insect-born diseases. The incidence of respiratory diseases, however, is lower than in the U.S. troops at home. "Indeed, we may be carrying more respiratory tract disease to Vietnam than we are bringing back," says Dr. Greenberg.

Intestinal disease is high because sanitation is poor in Vietnam. Most of it is represented by a diarrhea of short duration, probably caused by a

virus. The shortness of the disease means few cases arrive in the United States. There are some longer-duration diseases, like infectious hepatitis, amoebic and bacillary dysentery and salmonella infection, but they pose no threat because of the high level of hygiene here.

The hot, humid Vietnam environment promotes a variety of skin infections, but all respond rapidly to treatment.

Insect-born diseases include a small number of dengue, scrub typhus and a viral disease "with a delightful name of Chikungunya fever," says Dr. Greenberg.

Malaria is being brought back in considerable numbers and constitutes the most serious problem among returnees. Still, when the cases are scattered among 200,000,000 people, they constitute no hazard. Nevertheless, there are several widespread diseases in Vietnam that could provoke a problem here. One is tuberculosis. From 10 to 20 percent of the Vietnamese have TB. An epidemic of plague broke out in 1967, but it was checked by 30,000 injections of plague vaccine. U.S. troops get plague vaccine every six months. The rat and flea control programs in the U.S. compounds also have been effective. In addition, there are rigid control measures at U.S. ports of entry.

Cholera also is widespread among Vietnamese but none has been found in U.S. personnel so far. Japanese B. encephalitis has been reported in U.S. troops but none in returnees. Filariasis, a parasite disease, also has occurred in small number. Venereal disease is a continuing problem, but most personnel are under treatment before leaving Vietnam.

## Air curtain screens bacteria

A screening curtain of air can replace the plastic tent as a device to protect the hospital patient who must be guarded against contamination. Tests in the St. Francis Hospital, Hartford, Conn., show that the air curtain is acceptable to the patient and is remarkably effective in repelling bacteria.

Dr. Robert J. Husar says the air is brought into the room, passed through filters to remove bacteria and exposed to a bank of ultraviolet light tubes with germicidal rays. The purified air then flows into slots extending the length of the canopy-like plenum over the bed. As it escapes from the slots of the plenum at high velocity, the air produces a strong, isolating barrier against bacteria on all four sides of the bed. The air is exchanged every 30 seconds. Bacteria generated by the patient are thereby removed.

The uniqueness of the enclosure reduces the difficulties in nursing care often encountered in plastic isolators and reduces the patient's awareness of confinement. Despite the patient's isolation, a visitor may enter the room without a mask or gown as long as he remains beyond the curtain of air.

The barrier has been used to treat severe burn patients and could be useful in isolating patients with organ transplants and others who run a risk of increased infection because of low resistance.

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## Germ-free baby chamber

An infant whose life was feared threatened because of a congenital inability to fight bacterial has been delivered and maintained safely in a

"germ-free" isolator in London (See *Science Digest*, December, 1968, page 31).

The technique has been used hundreds of times to deliver germ-free animals, but this is the first reported delivery of a human being.

The mother, 23, was placed in a sterile, plastic tank along with instruments. Surgeons, inserting their arms into the tank through built-in sets of long rubber gloves, performed a cesarean operation and transferred the eight-pound germ-free infant through a connecting tunnel to a mobile isolator for resuscitation.

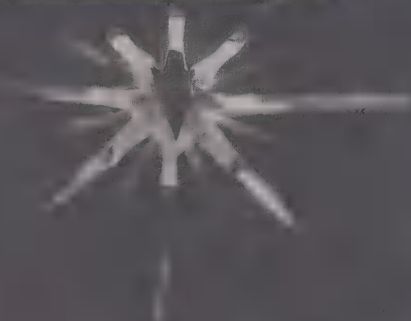
The precaution was taken because the baby's brother had died soon after birth from an infection. Believed to run in families, the disease is hypogammaglobulinemia, which is marked by an absence of antibodies in the blood and a lack of immunity machinery in the cells. Tests showed after six days, however, that the infant did not have the disease. She was removed from the isolator and returned in healthy condition to her mother's room. Preparations had been made to maintain her in the isolator for 28 days.

During the six days, normal nursing care, physical examinations and necessary injections were carried out within the isolator with no difficulty.

Doctors noted that isolators have been used to perform surgery on adults and to maintain transplanted patients in a germ-free condition. The successful delivery of an infant opens a new application for the technique, particularly to treat this disease which has been invariably fatal in the past. Had the baby become infected it was planned to graft tissue from another fetus to promote antibody production.



## NEW FOR INDUSTRY



This NASA technician at left is looking down the center of 3,000 pounds of live, solid rocket fuel which is used to power the escape rocket motor on the Apollo spacecraft. The weird star-shaped effect is the result of a tunnel that runs through the middle of the powerful fuel. The reason for the tunnel is to increase the burning surface of the fuel, resulting in a high thrust of nearly 150,000 pounds. Developed by Lockheed Propulsion, Redlands, Calif., rocket is designed to blast the spacecraft away from the launch vehicle in case of emergency.



IBM's computer memory is faster than ever thanks to some new microminiature circuits recently developed. (*Science Digest*, Jan. 1969.) These semiconductor memory units can store new information in 12-billionths of a second and provide previously-stored information in just seven-billionths of a second. Enormous amounts of information can be stored for future reference in the IBM computer, and to have it all available so fast is a boon to business, science and education. All the information is stored on tiny integrated circuits like the ones at right. They are resting on a definition from *Webster's New Collegiate Dictionary* for size comparison.

mem.o.ry \ 'm  
memoria, fr. m  
m. delay, G  
power of 100  
and retained  
modification  
active or ex



It looks like a giant salad bowl, but it's really a 700-pound glass hemisphere at the left that will be used in building an underwater research vessel. Produced by Pittsburgh Plate Glass for the U.S. Navy, the "bowl" will be joined by an identical hemisphere to form a 56-inch diameter glass bubble hull for a manned deep-sea vehicle. The reason for choosing glass as a building material for the vessel is because of its great strength even under the intense pressure of deep sea diving. This bubble, it is hoped, will carry Navy crews deeper than man has ever gone before. And the builders of the hemisphere believe the deeper it goes the stronger it becomes.

Cutting down on the noise from giant commercial aircraft may be possible by slowing down the huge fan in the turbofan engine. The enormous round structure at the right is the mouth of a Rolls-Royce RB .211 turbofan engine. It and two others will power Lockheed's new 1011 TriStar jetliner, intended for its maiden flight sometime next year. This engine is being tested in an open air test bed at Rolls-Royce's Hucknall Flight and Test Center at Nottingham, England. Noise pollution from industry and aircraft, which has recently been getting almost as much attention as the pollution of air and water, is a growing problem that, as yet, seems to have no solution.



A concrete preservative above called "concrete polymer" has been developed at the Brookhaven National Laboratory. This preservative makes concrete four times stronger, highly resistant to freeze-thaw damage and up to five times more resistant to other forms of erosion. (See page 77 of this issue.) This protection is obtained by first impregnating ordinary concrete with a special liquid plastic. Then the plastic is irradiated to transform it into a solid. The samples above show the difference between treated and untreated concrete. The sample on the left shows extensive freeze-thaw damage, while the sample on the right, the treated one, shows very little damage.





Department of the Navy

Two years ago this ship was purposely loaded with explosives to be scuttled and detonated at sea, but something went wrong, and it became an . . .

## Aleutian runaway

by Robert Davidson

**D**EEP in Arctic-chilled waters south of the Aleutian Islands, a giant bomb 800 feet long and 30 feet high settled toward the sea bottom—almost a mile deep—two years ago. It was, in fact, a World War II liberty ship, purposely loaded with explosives and deliberately scuttled. For weeks the charged hulk eluded a four-ship Navy task force whose mis-

sion was to find and detonate—on the bottom—this fused powder magazine. The colossal ocean-bottom blast was to be the grand finale in a project that became a hair-raising cliff-hanger for several dozen courageous men.

Known as Vela Uniform, the project was a joint venture of ARPA (Advanced Research Projects Agency) and the Navy, conceived in 1964. ARPA was charged with hon-



ing our ability to detect clandestine underwater nuclear explosions. The Navy's Chase VI operation was set up to dispose of obsolete and defective ammunition. The marriage seemed ideal: Navy could blow up its explosive garbage; ARPA could record explosive-wave data at seismic stations throughout the United States.

Early operations for Vela Uniform went according to plan. First, 40 five-ton explosive charges were detonated on the ocean bottom along a profile 1,100 miles southwest to 500 miles northeast of Amchitka Island in the Aleutian chain. A scientist-technician seismograph team measured and recorded the speed of reflected shock waves through the earth's crust, upper mantle and deep structure. The data was compared with seismic patterns from the underground nuclear test "Long Shot," set off October 1965 on Amchitka Island. Differences were carefully noted. They would help scientists determine natural earth tremors from illegal man-made shocks.

The climax of Vela Uniform was to be the single, massive detonation of the sunken liberty ship at the site of a recent earthquake, 32 miles south of Amchitka. The blast was to be the largest non-nuclear underwater explosion ever attempted. Amchitka is a low, flat member of the Rat Islands near the western extremity of the Aleutian chain.

On July 24, 1967, the retired liberty ship *Robert Louis Stevenson* departed from Bangor, Wash., towed by the commercial tug, *Star Crescent*, and accompanied by Navy fleet tug *USS Tatnuck*. Aboard the *Tatnuck* was a scuttling crew from Naval Ammunition Depot (NAD)

Bangor. Personnel from Underwater Systems, Inc., of Silver Springs, Md., were also there to make on-site measurements of the explosion and to record the pressure-time history of the shock wave.

Five thousand tons of cargo were stowed in the *Stevenson's* stripped-down hull. Nearly half consisted of explosives from NAD Bangor—mostly old mines, torpedo warheads and other defective World War II ordnance. Six underwater SUS bombs (water-pressure detonator) were packed into open detonator and booster holes of MK-51 mines with plastic explosive packed around them. Detonation was set for a water depth of 4,000 feet.

### ***Sinking the Stevenson***

On Thursday, August 10, the *Star Crescent* reached the test site. The Coast Guard cutter *USCGC Confidence* rendezvoused to provide surface surveillance during the scuttling operation. Weather was bad, with poor visibility and high winds. Without delay, the scuttling crew opened the *Stevenson's* seacocks, casting her adrift to sink.

Normally a scuttled liberty ship will sink in about three hours. But the *Stevenson* followed its own time schedule. As it drifted northward, toward Amchitka Island, it became apparent that the hulk's aging seacocks were defective. The weather worsened. Winds from the southeast whipped up to 20 knots; visibility shrank to 300 yards. Surveillance continued by radar as the *Stevenson* drifted northeast at one and a half knots, toward water only 3,000 feet deep. The ship's attitude was unknown, since fog shrouded the sea.

Twelve hours after the stubborn ship should have been planted firmly on the ocean bottom, the *Tatnuck* felt her way through the murk to survey the drifting maverick. The hulk was on an even keel, sinking slowly. Forward freeboard (distance between water line and deck) was seven feet, midships was five feet, aft was three. The detonators were inaccessible.

Then shortly before midnight the *Stevenson* slipped out of radar contact. The lethal runaway was submerged, drifting to the ocean floor; loaded, fused and undetonated.

### **Danger of detonation**

The Coast Guard issued an immediate notice to mariners. All ships were warned to stay at least 10 miles from the position at which the *Stevenson* was presumed sunk. The danger was that an unwary ship would sail over her, its passage providing just the extra pressure needed to detonate the underwater explosives and destroy any surface ship above it.

By Friday, August 11, word of the emergency reached the Naval Oceanographic Office in Washington, D.C. Capt. T. K. Treadwell, NAVOCEANO Commander, appointed a team of project officers for the search. Their first action was to order the Navy's newest deep-water survey ship, the *USNS Silas Bent*, to the Amchitka area.

Meanwhile an in-house collection was made of bathometric, magnetic, oceanographic, weather and navigational data for the emergency area. The Magnetics Division organized the crash assembly of a deep-towed magnetometer system similar to the

one used in 1963 to locate the wreckage of the nuclear submarine *Thresher*.

At the U.S. Naval Station in Kodiak, Alaska, Adm. Donald White, Commander of the Alaska Sea Frontier was designated Commander, Task Force 93, charged with resolving the crisis.

Available search equipment was evaluated by experts flown up from NAVOCEANO and by White's own personnel. A three-dimensional model was made of the priority search area—a two-mile-square section of the ocean floor about 20 miles southeast of Amchitka Island. Its center was pinpointed at the *Tatnuck's* last radar contact with the *Stevenson*.

The *Tatnuck* set out to probe the area electronically. *Confidence* ran perimeter patrol through crashing seas and murk to keep unauthorized shipping out of the area. En route she performed what search she could.

By Wednesday, August 16, a two-phase search plan had been laid out under Capt. Alfred F. Betzel, on-scene commander of the search. First, aircraft made bombing runs over the hulk's estimated position in order to force a sympathetic explosion or, hopefully, to create overpressure that would actuate the *Stevenson's* SUS bomb fuses. Nothing happened.

Phase two went into operation early the following week. NAVOCEANO had completed assembly of the deep-towed magnetometer system, and flew it to Adak Island. On Thursday, August 24, a three-man magnetometer search team headed by Jerry C. Carroll arrived on the scene. Meanwhile, crews of the *Bent*

*Exactly one month after the ship was lost, the USNS Bent sighted the runaway.*

and the *Confidence* had reanalyzed the original sinking position data. A new search area was pinpointed, centered a mile and a half from the original.

On Thursday, September 1, the master of the *Bent* stood on the bridge of his ship as it plunged through giant seas towing the deep magnetometer system. Trouble hounded the effort. At 1,000 feet, the magnetometer sensor leaked. Then there were electrical shorts in the cable. There was instability at slow speeds, and the system's sweep range was limited to 600 feet. Stability and sweep increased at higher speeds, but the towed vehicle was then so far behind the ship that its pings could not be received in the *Bent*.

Modifications were made over the weekend to improve the instrument's performance: Weights were added to make it ride deeper, and the sensor was relocated. Finally, the vehicle behaved, and its sweep range fanned out to a healthier 1,500 feet when moving at one and a half knots.

For days, the storm-weary *Bent* pitched and rolled over a criss-cross search pattern with no luck. Underwater cameras repeatedly recorded excellent photos of the ocean bottom—but no *Stevenson* showed up.

Excitement mounted and subsided in turns as the magnetometer picked up anomalies, but each was a false alarm—a steep slope on the ocean floor; the magnetometer vehicle brushing the ocean floor; an extension of the slope.

It was mid-afternoon on Septem-

ber 10 when a check of narrow-beam echo sounder records showed a faint outline of something about 800 feet long and 30 feet high at a depth of 2,790 feet, some 16 miles southwest of Aleut Point on Amchitka Island.

Quickly, the *Bent's* skipper swung his ship for two north-south magnetometer sweeps. Readings confirmed contact with a ship-sized object.

During the next 12 hours in wild seas that prevented bottom photos, the *Bent* passed over the contact point eight times, using narrow-beam sonar. Not only was there no explosion, which had been feared earlier, but analysis of data showed that the contact was indeed a ship, upright and in a northeast-southwest direction.

### **Sunken ship found!**

By next day, the seas moderated enough for the camera to be dropped. Two runs produced clear pictures of the ocean bottom—but no ship. On the fourth try, however, the crew hit pay dirt. Twenty-nine clear pictures of a sunken ship showed up when they were developed and analyzed back in Adak on Wednesday. The *Stevenson* had been found.

Bombing seemed the only answer. A marker buoy was to be implanted above the hulk. Twenty-four 2,000-pound bombs were modified for pressure activation at 2,500 feet depth. At the same time, bomb racks and release mechanisms were installed on Adak-based P-3 Orion air-



craft from Patrol Squadron 28. The plan was to generate overpressure near the *Stevenson* in order to trigger the hulk's SUS pressure-detonators.

A storm with high winds that had stymied operations since September 14 abated enough so that bombing could begin five days later. The *Bent* stood at a safe distance. The *Bauer* jockeyed closer to the target to assist navigation for the aircraft. Bombs were dropped singly or in groups of twos and threes.

All 24 bombs detonated as planned, several within the calculated 250-foot overpressure range. Four to seven strikes were within 60 feet of the hulk, near enough to trigger the *Stevenson's* SUS bombs, even if the pressure diaphragms were deteriorated by sea water. Yet the *Stevenson* refused to explode.

The chances are it never will. The

emergency officially ended at 9:30 a.m., Friday, September 23, 1967, six weeks after the bomb-loaded ship had faded into a fog bank off Amchitka Island. The Navy's final report states that evaluation of the bombing indicated that overpressure from the explosions was more than enough to detonate the hydrostatic fuses, had they been operable. It was further noted that rapid deterioration by the salt water would render the fuses inert within a matter of weeks.

But today, marine hydrographic notices and charts tell all passing mariners that the *Ex-SS Robert Louis Stevenson*, loaded with 2,000 tons of explosives, is sunk in 465 fathoms of water at position 51 deg 26 min 25 sec north and 178 deg 19 min 26 sec east. Even though the old hulk is corrosively defused, that's a good spot on the sea to avoid.



"I never dreamt that the increased fallout radiation could produce this kind of mutation."

## Keas:

those  
fine-  
feathered  
villains of  
New Zealand



IT ISN'T REALLY very fierce-looking. This drab bird, whose olive-green feathers are broadly edged with black, isn't quite 20 inches long. When you see it flapping its wings in a tree, the flash of bright red that colors the undersides of the wings makes the bird momentarily look like its more beautiful and more peaceful relatives of the parrot family. But keas have been held responsible for the deaths of hundreds of sheep; the destruction of personal property like convertible car tops, expensive cameras and camping tents; and countless cases of other kinds of vandalism.

Farmers claim that the kea is New Zealand's most vicious sheep-killer. It has a strong 2½-inch curved beak that tapers to a needle-sharp point. Sheep farmers believe that the birds use this formidable weapon to attach themselves to the sheep's back where they remove a patch of wool and then dig deeply into the animal's sides for the kidney fat. It's even claimed that keas will perch on the backs of sheep and ride them to death from exhaustion or from loss of blood.

The bird gets its name from the sound it makes: "eee-aaaaa!" Maori natives first named the bird which they believe to be utterly fearless. This bird thinks nothing of waddling boldly into your camp. A group of birds will often circle around any bright object, inspect it and then retire to a nearby rock or tree and appear to hold a conference about it. Many a camper has been exasperated when returning to his camp to find complete chaos—tent in shreds, equipment scattered all over the place—and an infuriating "eee-aaaaa!" from a tree just out of reach.

'Really beautiful stuff'

## TANZANITE



Gemological Institute of America

Tanzanite gemstone weighing 5.08 carats.

by Harold H. Brayman

**P**AUL DESAUTELS tugged open the doors to the safe. He picked up a piece of folded brown paper and opened it to reveal the largest *tanzanite* gem in existence, a 123-carat stone of dark, velvety blue.

"This may be the first commercially important gemstone discovery since Alexandrite in 1830," declared Desautels, supervisor of the division of mineralogy for the Smithsonian Institution in Washington, D.C., and probably the first person to identify tanzanite as a previously unknown

gem. He reached again into the safe and drew out a 98-carat sapphire set into a diamond necklace. "The tanzanite compares favorably with this \$140,000 sapphire. While the sapphire has a steely blue color, the tanzanite has a richer, velvety blue. This tanzanite is a fantastic material, really beautiful stuff."

The new gem has swept excitement through the gem business in recent months, sending buyers and prospectors stealthily scouring the African nation of Tanzania for more crystals. Tiffany & Co., the posh New York jeweler, showed at its San



San Francisco store its first piece of tanzanite jewelry, a pin with a floral design of diamonds surrounding a 50 carat stone. Later the pin was displayed in its Beverly Hills and Chicago stores. It went on sale recently along with several other tanzanite pieces—a necklace, two other pins and a ring and bracelet—at Tiffany's Fifth Avenue store.

"It's a most exciting stone," proclaims Henry B. Platt, head of Tiffany's diamond department. "It's got the beautiful blue color that has never been seen before except in a sapphire. Next to diamonds, blue is the most popular color in jewelry. It's the favorite color of most men, and they buy blue stones for their wives." Platt takes credit for coining the word tanzanite.

Interest isn't limited to the Tiffany trade, with its prices on diamond-and-tanzanite jewelry ranging up to \$50,000. Larter & Co., a Newark, N.J., jewelry manufacturer, added tanzanite to its catalog last month and has used 100 small stones in earrings, tie tacks and cuff links, priced from under \$50 to \$200. Though the uncertainty of supplies makes it tough to peg a price on tanzanite, the average price for an unset stone seems to run around \$150 a carat.

"Anyone who likes fine gems will love this stone," says one importer. "If I could get a bushel of it, I could sell it right away." He has actually received four small stones.

The gem's origins remain cloudy. The only certainty is its discovery in 1967 in Tanzania, probably in a stream bed. Much of the supply has since been smuggled out of Tanzania, causing many dealers to shun discussion of their sources for the gem.

Desautels saw his first stone in the spring of 1967, when a South African brought him for identification a pebble-sized piece of uncut tanzanite. Held to the light in one way, the stone holds a deep, purple-blue color; rotated slightly between the fingers, it takes on a rose coloring. By cutting or heat treating, jewelers can accentuate the blue and eliminate the less desirable rose.

"I talked him into selling it to the Smithsonian," says Desautels. "It was unique, the only one ever seen, and you grab at something unique. It cost us far more than it's worth, but it got us into tanzanite." The Smithsonian, familiar with the stone, was thus ready before other buyers to grab several lots that later came on the market. Some of the lots were sold by a New York department-store executive, who had received the mineral from his son. "My son was doing a water survey when a native came in and handed him the stuff," recalls the executive.

By winter 1967, news of the gem sent some gem buyers rushing to Tanzania to buy up supplies; Desautels calls it a "real stampede." Buyers representing Tiffany at the world's gem-cutting center in Germany set aside pieces for Platt's visit in January 1968. "When I saw them, I grabbed them and kept it quiet," he recalls. "We wanted more, not just a piece or two to sell to a collector, who would hide them away in a collection. We want to make beautiful homes for these gems, to show their true beauty by making them into decorative objects worn by beautiful women."

*Reprinted with permission from The National Observer © 1968.*

Slowly, more pieces filtered into the United States. By spring 1968, some pieces were being cut in this country. Desautels flew to Germany to look at an uncut hunk of tanzanite, then purchased the 123-carat gem. The Smithsonian is reported to have paid a bargain \$6,000 for it.

For all the excitement, one factor tempers the tanzanite enthusiasm: the known extent of the lode. The mineral zoisite, of which tanzanite is a variety, is found by the ton in California, Tennessee and other areas. Yet no gem zoisite had ever been found, causing some gem dealers to fear that the Tanzanian lode may be a tiny fluke of nature.

Such flukes in gems are common. A gem called taafeite was discovered in 1945, but only half a dozen pieces have been found since. The tanzanite lode already is pounds larger than the taafeite lode, yet it may lack the

magnitude to make a popular gem. "I've seen the recent lots, and they've been cloudy and fractured," declares Desautels. "Miserable. It happens a lot with minerals; the very first batch is the best."

Tiffany's Platt, too, worries that the vein may not last. But recently he became more optimistic. "I talked to Germany this morning, and they have just received another shipment of what they think will be the same quality they received at the beginning of October 1967," he says. "But it's hard to tell until it is cut."

The stone's commercial popularity awaits a more accurate assessment of its supply, as prospectors and traders scour Tanzania for claims and supplies. Yet like a diamond or ruby or any quality gem, the true measure is an esthetic one. By this standard, the rich blue sparkle of the tanzanite already stands as a major discovery.

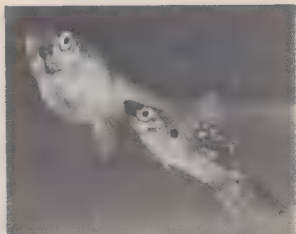
## A gem of a discovery

At the American Museum of Natural History in New York City, D.M. Vincent Manson, acting chairman of the Department of Mineralogy, calls tanzanite "perhaps the most exciting gem discovery of the 20th century. It's most attractive and it's a real gem. The properties of a gem are durability, attractiveness and rarity, and it has them all. It also has a particularly interesting property called 'trichoisim.' That means it has three colors depending on the way you look at it: blue, purplish-mauve and ruby red." Tanzanite blue, he notes, approaches that of the finest sapphire, while its mauve coloration resembles that of an amethyst. There are other changeable-hued stones but none, according to Manson, "with such an exciting range as Tanzanite." The Alexandrite gem mentioned by Desautels, for example, changes hues from green to red.

"Most of the tanzanite stones we see now have been heat-treated, which reinforces the blue hue and does away with the others," Manson adds. Jewelers, he explains, prefer to play it safe with the popular blue hue rather than encourage tastes for changeable-hued stones.

Tanzanite is a variety of the mineral zoisite, a not-too-common silicate that is usually an undistinguished gray or white in color. Occasionally, zoisite gives rise to thulite, a pink gem that has been found in Norway and Italy. Until now, no tanzanites had been discovered in zoisite lodes.

# Guppies — the amazing 'millions fish'



American Museum of Natural History

by George P. Nicholas

**I**N THE SPRING of 1866, from a shoal of a surging Trinidad brook, The Reverend R. J. Lechmere Guppy fished out a finny lilliputian and shipped it to the British Museum. Today, the guppy can be found throughout the non-arctic world. No bigger than the length of its scientific name (*Lebistes reticulatus*), neither game nor food, why is the guppy more talked about than even the one that got away?

First, it has adapted to life under glass with gusto. Some 20 million aquarium keepers in the United States number among their charges at least one pair of guppies. Then, as an experimental animal the guppy is a researcher's pet. The fish mutates like a kaleidoscope and continues to astound its keepers with its fertility.

Guppies have a remarkable breeding pattern. A female becomes fertilized at the age of two weeks. She gives birth at 90 days of age to as many as 187 young. And, she requires only one contact with a male to have up to eight broods of young at 28-day intervals.

But this amazing fertility is necessary for guppies. Far more so than with other animals, the male is the fair sex; to its many fish, bird and insect enemies it is a better target than

the Redcoats were for the Indians. In the wild few males live their full three years. To keep the species going, each must go a long way. There is also polygamy unlimited—males can fertilize their great-great-grandoffspring. Guppies easily live up to their other popular name, the millions fish.

But both experimental ichthyologists and a aquarium buffs have learned to rig the tank to promote even larger and more frequent spawnings. They light the aquarium 24 hours a day, just in case guppies keep a calendar and mark the passing of night and day. They raise the temperature to the ideal 72 degrees.

The American Guppy Association, which keeps tabs on guppies and holds shows, points with pride to emergence of the United States as the most consistent winner in international shows over the old guppy capital, Germany. Its points system ranks contest entrants on shape, size, color, condition and deportment.

Guppies give birth to live young rather than eggs. They come in a uniform drab olive. Aquarists distinguish the pregnant ones by looking for a dark spot caused by the eyes of their many young near the thin walls of the stomach region.

Female guppies are like Thurber's women, larger than their mates.



Man is

no

swinger



American Museum of Natural History

**M**AN'S ANCESTORS never swung on trees like the orangutans and the ancestors of the chimpanzees and gorillas, suggests Russell H. Tuttle of the *University of Chicago*. An anatomist and anthropologist, he draws his conclusions from a comparative study of the hands of men and apes.

The great apes, unlike men, have certain anatomical features adapted to tree living, such as hands with long curved fingers and relatively weak thumbs. Hands like these can easily be flexed into hooks for hanging and swinging from branches.

"Since man shows no signs of having possessed these specialized tree-living adaptations, I believe the

human family diverged from that of the apes before the animals displayed these special features," Dr. Tuttle says.

"From what we know about the mechanisms of evolution I find it highly improbable that the human species developed from an animal much like the modern chimpanzee. Its hand is too specialized for locomotion to be a predecessor of man's relatively unspecialized tool-using hand."

Man's emergence as a separate family may date back as far as 20 to 25 million years, according to Dr. Tuttle, which would make man ■ more distant relative of the chimpanzee and gorilla than some scientists



believe. He agrees, however, that African apes are man's closest living relative.

Chimpanzees and gorillas, who spend most of their time on the ground, apparently evolved from long-fingered, tree living ancestors like the modern-day orangutan. The orangutan has to walk on its fists or

palms when it comes down from a tree but chimps and gorillas walk on their knuckles. The adaptation gives them speed and a steady gait.

Man may never have walked on all fours like the chimp and gorilla, Dr. Tuttle adds. "Very early, the human predecessors showed marked pelvic and leg development."

### Miasma of malnutrition

Undernourished youngsters—like those now in Biafra—may show impairment of mental functions in later life as a result of their early deprivation. Chances are their stature will be lower than average, too, and that they'll be more susceptible to infection.

Two faculty members at the *University of Texas* have published a paper in *Science* showing that inadequate nutrition in infant animals goes hand in hand with smaller, more slowly developing brains. Both pigs and rats manifest the changes. In rats, malnourished infants may also show degenerative changes of neurons and neurological cells in the brain.

What does this mean for human infants? Drs. Heinz F. Eichenwald and Peggy Crooke Fry point out that observations of babies show inadequate feeding of pyridoxal phosphate, a coenzyme important in protein synthesis, results in changes in the physiological function of the brain. Within six weeks, the malnourished infants are hyperirritable, throw convulsive seizures and show behavioral disorders and abnormalities in development.

"These data suggest that inadequate protein nutrition or synthesis,

or both, during brain development could result in changes in function and that if the degree of deprivation were sufficiently severe and prolonged, the changes in functions might be permanent," they note.

Follow-up studies of children who have recovered from infantile marasmus and kwashiorkor, two diseases caused by early malnutrition, indicate that the youngsters' intellectual attainments are consistently lower than those of their well-fed peers.

Ocean system of the future was designed by Stan Nakaishi, industrial design student at California State College. The work pod he is adjusting will operate from larger deep submersible work vessel. Pod draws life support from the mother vehicle via umbilical cord.



The malnourished children are significantly shorter than average, too, with smaller heads. Also, they're highly susceptible to infection.

Perhaps the most alarming aspect of the University of Texas paper is the indication from experimentation with animals that poor nutrition of the infant female may affect the development of her offspring born many years later. Rats born of and suckled by malnourished mothers are as deficient in learning capacity as their deprived parent.

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### Out with books/in with movies

Students who read poorly may be able to move ahead in their school subjects by acquiring information through pictures, films, objects and sounds, says Dr. Melvin E. Levinson of *Brooklyn College*. He calls the new concept "audiovisual literacy." "I don't mean to minimize the importance of reading and writing," he says, "but the simple fact is that this generation has cut its intellectual teeth on movies, television, radio and records—the media are the means by which they are accustomed to assimilating information." Eventually, he maintains, a feedback effect will result in the development of a desire to read among the previously unmotivated.

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### Pre-Christian Canterbury

Underneath England's Canterbury Cathedral is a pre-Christian structure that may date back to 2300 B.C., says Dr. Lyle Borst of the *State University of New York at Buffalo*.

The present cathedral dates from Norman times, but it was built over

an Anglo-Saxon Church that burned in A.D. 1087. Underneath the older church was a pre-Christian monument that probably resembled the monument at Woodhenge, near Stonehenge, England. The remains of Woodhenge consist of 160 post holes arranged in six concentric figures, surrounded by a ditch and bank. The monument is built in the shape of a perfect Pythagorean triangle even though it was built 1,000 years before Pythagoras.

The crypt of Canterbury, too, is based on a Pythagorean triangle. Furthermore, slight deviations in the alignment of the present cathedral's nave, choir and Trinity Chapel indicate that these were placed over earlier structures built at different times and aligned with the changing declinations of the star Betelgeuse. Aligning buildings with stars was common in the pre-Christian era.

By calculating Betelgeuse's declinations, Dr. Borst postulates that the earliest structure, which is under Trinity Chapel, was built around 2300 B.C.

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### Boys read fast too

Girls do not gain reading skills faster than boys when computers are the teachers. In a *Stanford University* study, boys and girls using computers to learn reading turned out evenly matched. Dr. Richard Atkinson of Stanford explained that the individualized instruction of the computer is what counts. It holds the attention of boy students in a way a teacher trying to control a class can never do and lets him move at his own pace. In ordinary classes, girls are more attentive, apply themselves better and move with the pace of the class.

# Paint-on preservation for ancient stone

Arresting stone decay is the goal of a new colorless liquid that is painted on. With it, architectural treasures and monuments, once doomed to eventual deterioration, may be saved forever.

by Barbara O'Connell

**B**ETWEEN SEMESTERS at New York University in February, 1968, a chemistry professor, Dr. Seymour Z. Lewin, flew to Lallibilla, Ethiopia. The tiny town, built on top of a volcanic mountain, boasts an unusual monument: a group of stone churches dating from the 11th century. The churches were built below the ground level by cutting down into the mountain on which the town stands. The lower stonework of the churches has been deteriorating noticeably, a casualty of the moist climate. After an examination of the churches, Dr. Lewin carefully painted a strip of colorless liquid on 10 different areas of the stonework—a total of about 200 square yards.

Chips of the treated stone are sent to him at New York University at regular intervals. All show the same effect: the deterioration of stone that had gone on for almost a thousand years has been arrested.

The colorless liquid he painted on the Lallibilla churches is a stone preservative, one of two liquid preservatives he has invented recently. In the past two years, he has painted one or the other of them on selected portions of crumbling stonework all

over the world. In every case, he says, the deterioration has stopped.

"I've field-tested one of my processes for two years and the other for one year with the same results," he notes. The process used, he says, depends on the type of stone. Volcanic rock like that at Lallibilla, as well as sandstone and granite, gets one treat-

Dr. Seymour Lewin paints old gravestones on Curacao in West Indies with colorless liquid preservative he invented. Stones are then covered with tarpaulin for three weeks. Oil refinery next door to graveyard is causing decay of stones, some dating from 1600s.





Carved stone pillar in Arezzo, Italy, shows corrosive effect of weather on projecting surfaces which are not washed free of dirt and acid by rainwater. Flat surfaces withstand ravages of the elements much better. Stone preservative is being applied to some selected stone in Arezzo with good results.

ment; marble and limestone get the other. The marble and limestone preservative, the first to be invented, is being patented by NYU. "Around here," he says, "we call the first one 'LSP'—for Lewin's Stone Preservative."

Dr. Lewin has brushed the liquids on Mayan ruins in Guatemala, buildings at Brigham Young University in Utah, historic Jewish graves on Curacao in the Netherlands Antilles and on a number of sites in New York City: Trinity Church gravestones, the Brooklyn Museum's outdoor sculpture garden and the Cloisters Museum. He has made small scale tests in Washington, D.C., Boston, Brussels, London, Florence, Arezzo (Italy) and about a dozen other sites. Coming up on his schedule are

the Parthenon in Athens, Greece, and the giant heads of Easter Island.

At this stage in the development of the preservatives, Dr. Lewin limits the treatment to selected portions of stonework to see how effective it will be. At Curacao, however, all 2,567 marble gravestones are being painted with preservative as quickly as possible. "I painted 67 of them myself this summer, so that left 2,500 to go," he says. The reason for the rush job is the "desperate" status of the graveyard, the earliest stones in which date from 1620. The graveyard is next door to a huge petroleum refinery that processes Venezuelan oil exclusively. Venezuelan oil is rich in sulphur, much of which is removed in processing but goes up the refinery chimneys into the Curacao air.

"The deterioration has been intensified in the last four to five years," says Dr. Lewin. He demonstrates with slides, some taken five years ago, some this past summer. In the earlier slides, the carving is distinct and the inscription easily readable; in the later ones, the carving appears to have been gouged out of the marble with a knife.

"Sulphur dioxide, you know, is one of the prime components in air pollution," Dr. Lewin points out.

What happens when air pollution attacks stonework? On marble and limestone, which are vulnerable to pollutants, a layer of calcium sulphate is formed that slowly eats away the surface. Some of the calcium sulphate is absorbed by the stone when it gets wet, then redeposited when it dries, causing blistering. Where climactic conditions are right, both processes can readily be seen at work in exposed stonework with



projecting surfaces and carving. At Oxford University, the classroom buildings are literally crumbling; in Brussels, Belgium, the window sills of the Guild Hall are visibly worn; at the New York City Public Library, a marble balustrade recently tumbled to the ground; in Arezzo, Italy, a carved column has lost much of its detail. The stone on the 16th century Bodleian Library at Oxford is in such poor condition that it is being removed and new stone of the same kind applied.

"In 20 years it will be just as bad as the original stone," predicts Dr. Lewin.

Sometimes deteriorating stone poses a hazard. In most large cities, cornices not infrequently drop from older buildings, occasionally hitting a pedestrian. "One day I was walking outside the French Consulate in Manhattan when a piece of cornice came tumbling down about two feet away," says Dr. Lewin.

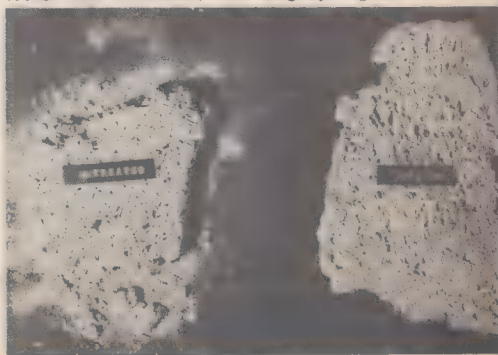
Not all deterioration of marble and limestone can be blamed on pollutants. In remote Tikal in the Guatemalan jungle, the carbon dioxide produced by the heavy vegetation is dissolved in rainwater, attacking the ancient Mayan limestone and dissolving it as calcium bicarbonate. The constant cycling of the weather between wet and dry produces blisters and peeling, effects that are much the same as those produced by air pollutants, but happen much more slowly.

Water plays a big role, too, in the deterioration of volcanic rock, sandstone and even granite. Although these stones are impervious to air pollution, sandstone and lava are not structurally sound and eventually peel apart like a deck of cards under

the influence of too much moisture. Even granite, one of the most durable of stones, will succumb to moisture in time. The hieroglyphics on the granite obelisk in New York's Central Park are partially obliterated because those parts of the monument were exposed to salty water from the Nile River for some 1,200 years. When the monument was removed from the river bank and shipped off to New York in the late 19th century, the salt in the tiny cracks around the carved surfaces hydrated and swelled. Chips of granite began falling off.

The falling chips worried the city fathers, who hired a company formed solely to treat the obelisk. The firm erected a huge shed over the obelisk, built fires and applied hot asphalt to the surface of the shaft. The treatment was "irrelevant," according to Dr. Lewin. Nevertheless, he says, the company is still in business, apparently on the strength of its work on the obelisk.

Chunk of limestone at right has been treated with one of Dr. Seymour Lewin's stone preservatives; chunk at left is untreated. The powder substance around untreated stone is composed of pieces that have crumbled off. Despite harder consistency, treated stone looks like untreated, but slightly lighter.



Not all stonework emerges as well from efforts to preserve it. Dr. Lewin has slides showing how a resin painted on some of the gravestones at Curacao has darkened them without protecting them.

To be effective, he says, a stone preservative must be inexpensive to use, long lasting in its effects and easy to apply. His two processes seem to fill the bill on all counts. Both involve the same three steps. The stones are first painted with an ordinary paint brush. Then the treated surfaces are covered with tarpaulins to prevent the liquid from being washed away during the time the chemical needs to work—about three weeks. After that, the tarpaulins are removed and rain allowed to wash off the residue.

The result is a stone that is slightly lighter in color (usually a desirable quality) but that otherwise looks almost exactly like it did before the treatment. I examined several pieces of marble and limestone treated with the first process and noted that although they looked the same as the

untreated samples, the treated ones felt much harder. Dr. Lewin pointed out that they were also much less porous. "The cracks fill in, too, somewhat," he said, demonstrating how two stones had been welded together with the process. "It's important," he added, "not to seal these stones completely but to reduce porosity." A complete seal traps moisture in the stone, resulting in deterioration.

The solution works on marble and limestone by depositing a substance called barium cabonate between the crystals of calcium carbonate that make up the stone. A sort of "bridge" is formed between the particles. The result, obviously, is less porosity, but there is another effect. "The great advantage of barium carbonate is that when it begins to weather, it becomes barium sulphate on the surface, which is one of the most insoluable substances known," says Dr. Lewin. "It's no longer subject to air pollution at all."

The second preservative, which looks like the first but is a little thinner, acts differently. Since the newer process isn't yet patented, Dr. Lewin won't reveal exactly how it acts, but he says that it both reduces porosity and provides some water repellancy.

Both processes, he says, will provide indefinite protection, although in moist climates some slight deterioration may take place in a few hundred years—as much, for example, as would take place in a monument made of a durable stone like granite. "If you want to erect a monument to yourself and you want it to last forever, choose granite and put it in a place free of moisture," he says. How about simply coating it with his preservative? "That's another alternative," he says with a smile.



# Your chemical thermostat

Mysteries of the hypothalamus, once known only as part of the brain, are at last being uncovered. The tiny structure controls body temperature. Knowing this, man may one day regulate all vital body and mental functions with a simple drug.

by Charles H. Coleman

**Y**OU HAVE a chemical thermostat, and it may be the secret to combatting high fever, reducing high blood pressure and stopping severe hemorrhages after an accident or during surgery. It may even help in the exploration of outer space. This almost magical-sounding thermostat is situated in the mid-region of your brain, and it controls the temperature of your body. It also seems to control the feelings of hunger, thirst and your emotions.

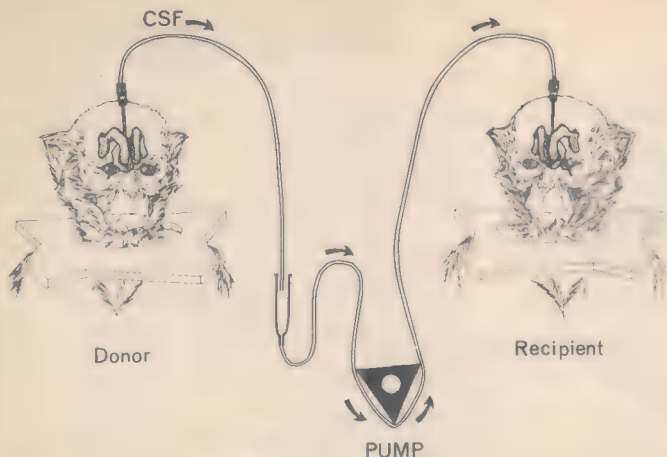
Dr. Robert D. Myers of Purdue University, Lafayette, Ind., discovered the chemical thermostat when working on monkeys, cats and other animals. The 35-year-old Purdue professor, who works in the university's neuropsychology laboratory, believes that many of the secrets of man's behavior are controlled by chemicals acting on the hypothalamus in the brain. The hypothalamus

is a small prune-sized structure located centrally at the base of the brain. Scientists have long puzzled as to what it does—now it seems that the hypothalamus controls temperature and other behavior. Experiments that Myers has performed on rhesus monkeys seem to prove this.

Fluid transferred from the hypothalamus of one monkey who is shivering from cold into the hypothalamus of another monkey at normal temperature causes the latter to shiver.

Fluid from a hungry monkey causes a full monkey to gorge himself. Fluid from a thirsty monkey causes a full monkey to drink excessively. Yet fluid from a normal monkey who is not hot or cold, not hungry or thirsty, does not affect another monkey.

"I see no reason," Dr. Myers says, "why an oral drug cannot one day be produced to selectively regulate all vital body and mental functions individually."



Transference of hypothalamic fluid from donor to recipient monkey is illustrated in this diagram. A small tube connected to a pump takes cerebro-spinal fluid (CSF) from the hypothalamus of the donor and delivers it to the same part of the brain in the recipient. Feelings of heat, cold, thirst and hunger have been transferred from donor to recipient, proving Dr. Myers' "thermostat" theory.



Hypodermic needle which is inserted into the front part of the monkey's hypothalamus is shown in this profile X ray. The monkey is facing left. The needle is hollow and made of stainless steel. Dr. Myers says the careful surgical techniques and sterile conditions under which the experiments are conducted prevent the monkey from suffering any undue pain or discomfort.

Rhesus monkey being prepared for an experiment on the hypothalamus is placed in a specially constructed stainless steel and plastic chair. Dr. Robert D. Myers discovered that the hypothalamus acts as a chemical thermostat for the body through such experiments with monkeys. Until Dr. Myers' discovery, almost nothing had been known about the function of this very small part of the brain.





For his experiments, Dr. Myers uses surgical techniques to implant the tip of a hollow needle into the hypothalamus of a monkey's brain. The monkey donating the fluid is called the donor.

Another monkey is prepared in like manner and is called the recipient, since he receives the fluid from the donor. Both monkeys are seated in specially constructed stainless steel and plastic chairs. A small tube connected to a pump pulls CSF (cerebro-spinal fluid) from the hypothalamus of the donor and delivers it to the hypothalamus of the recipient.

The fluid is not under pressure and the careful surgical technique and sterile conditions prevent pain and discomfort to the monkeys. This technique is the first that has permitted this type of experiment to be

Surgical technique used by Dr. Myers and associates for implanting the hollow needle into the hypothalamus of the donor and recipient monkeys is the same as would be used in any medical operation on a human. These sterile operative conditions keep the monkeys free of infection or possible disease.



done on animals that are wide awake. The results are amazing.

Whatever is done to the donor seems to be felt by the recipient. In the temperature-change experiments the donor monkey was cooled by placing dry ice into its chair chamber. In 15 to 30 minutes it started to shiver. Then some of its CSF was transferred to the recipient monkey who was at normal room temperature. The recipient monkey started to shiver in two to five minutes. His temperature rose about four degrees.

Heating the donor monkey had the inverse effect on the recipient monkey. As the donor grew hotter, the recipient got cooler.

Evidently some chemical from the brain of the donor was being transferred to the brain of the recipient causing the recipient to act as if he were undergoing the same treatment as the donor. Experiments indicated that the chemical causing the recipient to get warmer might be serotonin. Norepinephrine appeared to be the chemical causing the cooling effect.

Dr. Myers believes that these drugs, or ones like them, may be used in combating sickness. "It is entirely conceivable," he says, "that, given the biochemical code of the hypothalamus, new long-lasting drugs could be developed to combat high fevers caused by infectious diseases or brain injuries. These, or similar drugs, could likewise be employed to selectively lower body temperature in order to produce deep hypothermia for reducing blood pressure, bleeding and metabolic activity during major surgery on such vital organs as the heart and brain."

Dr. Myers also sees the possible

use of these drugs in space exploration. "The regulation of body temperature," he says, "in unusual or abnormal environments could also be facilitated by appropriate drugs. It may be possible to modify and then stabilize temperature at slightly higher or lower levels so that an uncomfortable environment would become more tolerable."

"It is entirely probable," Dr. Myers says, "that in the years to come, the chemical systems of the brain can be organized in order that temperature and basal metabolism are reduced to a pre-selected point for protracted periods of time. For certain kinds of space exploration, it would be desirable if not essential to slow man's high metabolic activity to a point where such problems as oxygen requirements, waste and sleep could be overcome."

Dr. Myers is also testing the effects of alcohol on the brain. It may be that the proper medicines administered in the right way, will solve the enigma of problem drinkers. Smokers, overweight people and drug addicts might be helped, or anyone suffering from ills caused from chemicals acting adversely on the brain.

"In any event," Dr. Myers says, "the future appears to hold great promise for artificial external control over the regulating systems in the human brain."

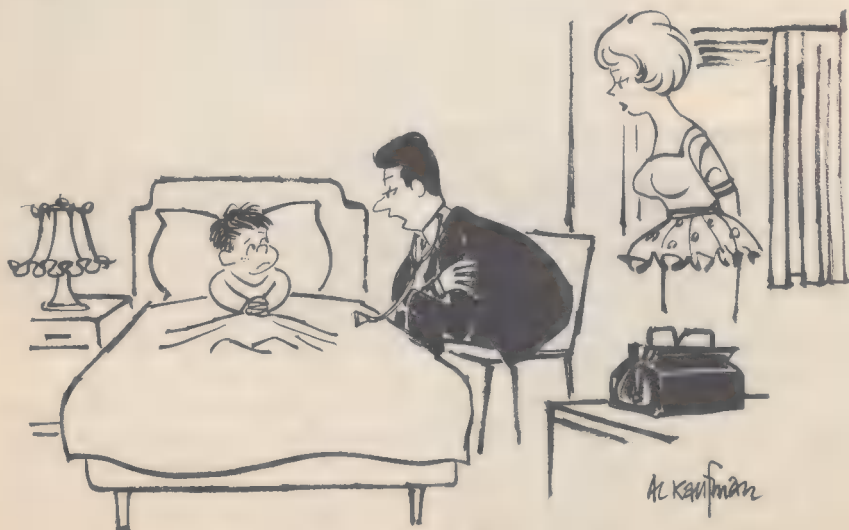
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#### For further reading

*Medical News Letter, United States Navy. Vol. 50, No. 7, October 6, 1967, pages 8-12.*

*Science Line, Purdue University. Vol. 2, No. 3, April 1967.*

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"You can quit faking. You're really sick."

## ECG by telephone

**A**N ELECTROCARDIOGRAM, the taped record of the minute electrical signals caused by action of the heart muscle, can now be made with the aid of a telephone when the patient is miles away.

The necessary electrodes are usually fastened to a patient's body by a nurse in a doctor's office or hospital. A member of the patient's family can now place them with the aid of a patented vest.

William H. Tygart, a development engineer for the Lockheed Aircraft's industrial products branch in Atlanta, was granted Patents 3,462,150 and 3,426,151 for the transmitter and receiver that are used.

Earlier, Ernest W. Fuller, another Lockheed engineer, was awarded Patent 3,409,007 for the vest. When it is worn, the electrodes are in place on the torso, and others are attached to arm and leg bands.

Wires from the electrodes are run to the transmitter, on which a telephone receiver can be laid. Both the transmitter and the receiver (intended

for the doctor's office or hospital) are portable and battery-powered.

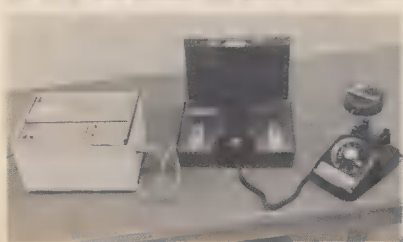
The receiver converts the audible signals for the machine that makes the electrocardiogram, or ECG. No actual wire connection to the telephone is necessary.

A Lockheed spokesman said ■ heart patient could sleep in the vest, dial the proper number and lay his telephone receiver on the transmitter. At the hospital, a physician can read the ECG and give the patient advice by telephone.

The company has received favorable medical reports on tests in Georgia, New Jersey, Nevada and California. The system has been successfully operated by radiotelephone to transmit the symptoms of a person seated in an automobile, and its sponsors believe it can be used from ■ ship, airplane or ambulance.

Lockheed would be glad to license a manufacturer. The retail price of the Cardio-fax transmitter is estimated at \$300 or \$400, and higher for the receiver. —Stacy V. Jones

Electrode vest is worn by heart patient. Wires from the vest are run to a transmitter on which a telephone is placed. The receiver, shown at left next to a conventional ECG recorder, converts audible signals it receives on the phone in the hospital or doctor's office. Physician reads the ECG and advises the patient by phone.





## ISAAC ASIMOV EXPLAINS

Each month Dr. Isaac Asimov chooses one of the questions you send in to answer. He does not make the job easy on himself, for in past months he has written about such things as relativity, parity and the basic nature of light. Following Dr. Asimov's answer are the answers to some of your other questions written by regular members of the *Science Digest* staff.

# Can anti-gravity really exist?

What is anti-gravity? How can it be studied?

There are two types of fields, electromagnetic and gravitational, which fall off in intensity as the square of the distance. This fall in intensity is slow enough to enable an electromagnetic or gravitational field to be detectable at large distances. The earth is firmly held in the grip of the sun's gravitational field even though the sun is 93 million miles away.

The gravitational field is far the weaker of the two, however. The electromagnetic field set up by an electron is something like four million trillion trillion trillion times as strong as the gravitational field it sets up.

Of course, gravitational fields *seem* strong. We all have painful experience concerning the strength of the earth's gravitational field every time we fall. But that is only because the

earth is so huge. Every tiny fragment of it contributes to the gravitational field and in the end the total is enormous.

But suppose we take a hundred million electrons (a quantity too little to see in a microscope if collected in one spot) and scatter them through a volume the size of the earth. They would set up an electromagnetic field equal to the gravitational field of the entire massive earth.

Why aren't we more aware of electromagnetic fields than of gravitational fields?

That is where another difference comes in. There are two kinds of electric charge, called positive and negative, so that an electromagnetic field can result in attraction (between a positive and a negative charge) or repulsion (between two positive or two negative charges.) In fact, if the earth's volume contained nothing



but a hundred million electrons, those electrons would repel each other and scatter far and wide.

The forces of electromagnetic attraction and repulsion serve to mix positive and negative charges thoroughly so that the effect of those charges tends to cancel out. Very tiny electron excesses and deficiencies can be brought about and it is the electromagnetic fields of those tiny excesses and deficiencies that we study.

The gravitational field, however, seems to produce *only* a force of attraction. Every object possessing mass attracts every other object possessing mass and as mass piles up so does the intensity of the gravitational field without ever any cancellation.

If a massive object *repelled* another massive object with the same intensity and the same manner as those objects attract each other under the usual gravitational conditions, then we would have "anti-gravity" or "negative gravity."

Such gravitational repulsion has

never been detected, but that may be because all the ordinary objects we can study in detail are made up of ordinary particles.

There are also "anti-particles," which are just like the common particles we know, except for the reversal of the electromagnetic field. Where a particular particle has a negative charge, the corresponding anti-particle has a positive charge, and so on. Perhaps anti-particles have the gravitational field reversed also. Two anti-particles would then attract each other gravitationally just as two particles do, but an anti-particle would *repel* an ordinary one.

The trouble is that a gravitational field is so weak, it can't be detected in individual particles or anti-particles but only for sizable masses. We have sizable masses of particles but no one has ever collected a sizable mass of anti-particles in one place. Nor has anyone ever suggested any practical alternate way of detecting anti-gravitational effects.

—Isaac Asimov

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## Will men ever explore the planet Pluto?

If men do explore Pluto, they will have to be well protected from the unfriendly atmosphere of this planet. Pluto is cold. The temperature is expected to be about  $-418^{\circ}\text{F}$ . on the dark side and to warm up to a chilly  $-328^{\circ}\text{F}$ . on the sunny side. When Pluto is farthest from the sun, caused by its eccentric orbit, the sunlit side will get no warmer than  $-375^{\circ}\text{F}$ . To compare that temperature with earth's, a winter day in Siberia may be as cold as  $-45^{\circ}\text{F}$ .

To offer other obstacles to explorers, Pluto will have almost no atmosphere on the dark side. Temperatures are too low. Only traces of atmospheric helium and possibly hydrogen can remain gas in such cold weather. On the bright side of Pluto, neon, if there is any, might become a gas when warmed by the sun, but will condense out as rain or snow on the dark side.

Surface conditions do change as the planet rotates once every six days, nine hours and seventeen minutes. The changes can be seen from earth as the frozen dark side of Pluto

rotates into the sun's path. Then nitrogen, frozen on the dark side, apparently melts as it is brought into the sunlight. Travelers to the planet would have to bring their own atmosphere to breathe, not to mention self-warming space suits that were dependable in such a cold climate.

The explorers may have to wear weights so they can walk about Pluto without flying off into space. The gravity on the planet is much weaker than earth's, since Pluto has a mass only one-tenth to one-twentieth as great as the earth, although the diameter is about two-fifths that of earth.

The discovery of Pluto in 1930 "must remain one of the greatest

freak coincidences in the history of science," according to Dr. Robert Hardie of Vanderbilt University.

Pluto was found in a "predicted" position, based on mathematical calculations. Astronomers had found that the orbits of the planets Neptune and Uranus were not following the exact paths they should. The men assumed the gravitational pull of another, unknown planet was to blame for the eccentric orbits. Calculations suggested where the planet might exist, and 25 years later Pluto was sighted near that predicted position. Just recently astronomers have confirmed that Pluto is not dense enough to have made a difference in Neptune and Uranus's orbits.—JR



"If they'd had fluoridated wine when I was young, I'd probably still have my teeth."

# How good an electrician are you?

by John and Molly Daugherty

**P**HYSICS covers a broad range of topics including mechanics, heat, sound, light, modern physics, magnetism and electricity.

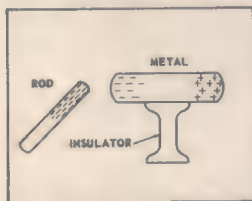
Static electric charges, evidence of the electrical nature of matter, makes dust and lint cling to records. Friction charges records negatively. Radioactive polonium, giving off alpha particles (positive charges), may be used to neutralize negatively-charged records so you can brush off dust and lint.

What do you know about electricity?

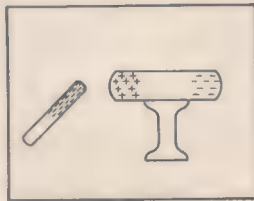
1. When you rub a hard rubber rod with fur (or wool), the rod becomes negatively charged. The excess electrons on the rod come from the fur, which then has a deficiency of electrons. The fur now has a positive charge.

When you hold the charged rubber rod near an insulated metal conductor, an *induced* charge appears on the metal surface.

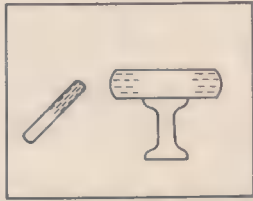
Choose the picture which shows the correct distribution of those charges.



1-a



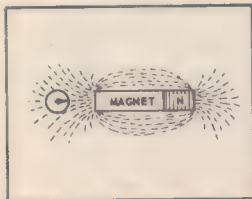
1-b



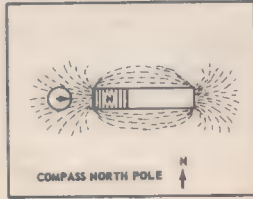
1-c

2. Magnetism has been known for many centuries. The ancient Chinese used magnetic iron ore to fashion a crude compass. You can visualize the magnetic field around a magnet by sprinkling iron filings around a magnet on a cardboard. Each iron filing becomes a magnet by induction from the permanent magnet and has a north and south pole.

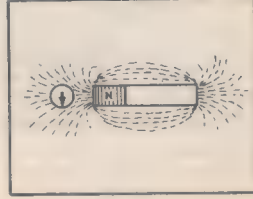
Choose the picture that shows how a magnetic compass reacts to the magnet.



2-a



2-b

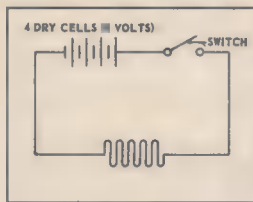


2-c

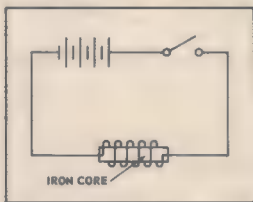
3. When you send an electric current through a wire, an electric field is set up close to the wire. This invisible magnetic field of force is in concentric circles about the wire. When you coil up the wire into a helix, and a current flows

through it, it becomes an electromagnet with a north pole at one end and a south pole at the other.

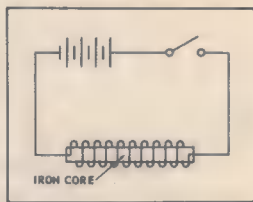
Choose the strongest electromagnet.



3-a



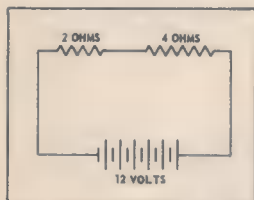
3-b



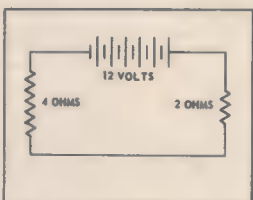
3-c

4. An electric current is a flow of electrons through a conductor in an electric circuit. Copper and silver are excellent conductors. Some metals and alloys such as the wire in your electric toaster offer resistance to the flow of electrons. The amount of resistance is measured in ohms. An electromotive force (volts) from a source such as a battery drives the current around the circuit.

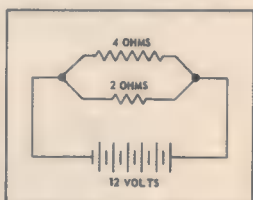
Choose the picture in which the most current flows around the circuit.



4-a



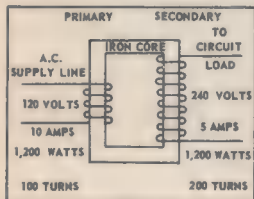
4-b



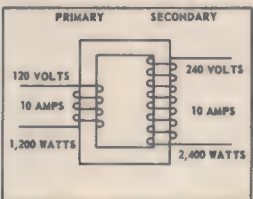
4-c

5. With a transformer you can transmit electrical power great distances efficiently with little heat loss. It operates on alternating current producing a continuously changing magnetic field through the iron core of the transformer. There are no moving parts. If the primary has 100 turns of wire, its voltage will double if the secondary coil has 200 turns.

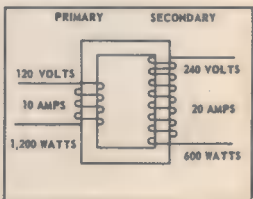
Choose the picture which shows the correct number of watts and amperes of current coming from the secondary side of the transformer.



5-a



5-b



5-c

## Answers:

**1-b.** The *induced* charge on the end of the metal conductor near the rod is always opposite to that on the rod. The rod repels some electrons to the



far end leaving the near end deficient in electrons and therefore positive. If you remove the rod, the *induced* charge disappears and the metal becomes neutral again because there is neither excess nor deficiency electrons. Like charges repel and unlike charges attract.

**2-a.** The end of the permanent magnet opposite its N-pole is a S-pole, and the N-pole of the compass is attracted to the S-pole of the magnet. Unlike poles attract, and like poles repel each other. The direction of the magnetic lines about the magnet's S-pole is *in*. If you placed the compass near the N-pole of the magnet, it would point *out*. Lines of force point *out* from the N-pole and *in* toward the S-pole. Close to a magnet, the earth's magnetic field has no noticeable effect on the compass.

**3-c.** When you wrap insulated wire around an iron core, you increase its magnetic strength. Iron makes a better path than air does for magnetic lines. But the magnetic strength increases further when you add (within limits) additional turns of wire. Increasing the voltage of the source also increases the magnetic strength (limited to the ability of the wire to carry the increased current).

**4-c.** When two resistances are parallel in a divided path, the resistance effective to the flow of current is *less* than the lesser of the two. Here the

effective resistance is only  $\frac{4}{3}$  ohms. You calculate effective resistance R

thus:  $\frac{1}{R} = \frac{1}{r} + \frac{1}{r}$   $\frac{1}{R} = \frac{1}{4} + \frac{1}{2} = \frac{3}{4}$  and so  $R = \frac{4}{3}$  ohms. Since

current depends *directly* on the volts and *inversely* on ohms, the current in

amperes =  $\frac{12 \text{ volts}}{\frac{4}{3} \text{ ohms}} = 9$  amperes. Since the current divides where the

parallel resistances are, 6 amperes of the 9 go through the 2 ohms and 3 amperes in the 4 ohms. In both 4-a and 4-b the two resistances are in a series circuit, so the effective resistance is equal to the sum of 2 ohms and 4 ohms = 6 ohms. The order in which they are used makes no difference.

**5-a.** The correct answers are 1200 watts and 5 amperes. If the voltage doubles in the secondary, the current is cut in half. Theoretically, the number of watts entering the primary matches the number of watts from the secondary because the transformer is very efficient. Five amperes times 240 volts = 1,200 watts.

**Score yourself:** 4—5 right  
2—3 right  
0—1 right

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## The views from space— poetic and prosaic

*Exploring Space with a Camera. Compiled and edited by Edgar M. Cortright. The National Aeronautics and Space Administration. (\$4.25). Around the World—a View from Space. Published by Rand McNally and Company. (\$4.95).*

Both of these books deal with essentially the same subject—photographs taken during the U.S. space program. But beyond a superficial resemblance, they are worlds apart in attitude, intent and (ultimately) kind of success.

The NASA volume is a scientific and historical account of the exploration of space first by machines and later by man himself. It is loaded with fact, statistic, description and analysis of the space program and its successes. There is a delicate balance between text and photographs, and nothing about the book is merely decorative.

As an almost direct opposite, the Rand McNally volume is a sort of poetic geography lesson about the planet earth. It leans heavily on the use of photographs and keeps text down to a minimum at all times.

Achievement, exploration and an aggressive reaching-out is apparent throughout the NASA book. There is constant analysis and explanation of every step toward the stars.

*Around the World*, by comparison, concerns itself not with reaching out but looking backwards at the earth from space, not with asking why but merely sitting back and observing—a sort of emotional bath in

the utter beauty of this planet from such great distance.

James E. Webb, NASA administrator, says in *Exploring Space with a Camera*, "Photographs from space tell only part of man's reach through the air and on into space. Cameras cannot show the data gathered by many kinds of scientific sensors. They also fail to reflect—except inferentially—the immense impact that our air and space efforts have had on broad areas of life on earth."

And there, in a nutshell, is the intent of the NASA volume. The space program is *not* merely magnificent color photographs—it is men and machines and collective genius.

The Rand McNally book says, "... the men who looked on earth from orbit primarily are engineers, super-technicians, scientists. Fundamentally they are prosaic-minded; not poets, not emotional and voluble by the very nature of their professions. And yet these men while in flight spoke words of blank verse:

'I looked down and the atmosphere was blue, I looked up and space was black.'

'It was so vast, so beautiful and overpowering that somehow man and all his problems seemed insignificant.'

"... The effort was to gather . . . those pictures which would permit each reader the privileges of viewing earth in all its grandeur, its fantastic attraction for mortals, its loveliness, its variety, its isolation, its cruelty, its mystery. . . ."

The difference between the two books is undeniably clear. And the

NASA volume is obviously the superior one—but there is something missing from it, and I think that the missing element is found in the Rand McNally book. *Around the World* is more of a *celebration* than a report or a lesson, and its 128 pages are a

frenzy of color and abstract shapes. At times the photographs are so stunning, so intensely beautiful that one is a little astonished they turn out to be the world.

Which book should you buy? By all means buy them both.—DC

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*B.F. Skinner: The Man and His Ideas. Richard I. Evans. E.P. Dutton & Co. (\$4.50).* Anyone interested in psychology or B.F. Skinner in particular will find this an informative look at one of the most influential contemporary psychologists. Prof. Skinner discusses himself and his point of view in the dialogue with Dr. Evans, a professor of psychology at the University of Houston.

*America's First Civilization: Discovering the Olmec. Michael D. Coe. American Heritage Publishing Co. The Smithsonian Library. (\$4.95).* The fascinating story of the Olmec Indians of Mexico—Mesoamerica's first inhabitants—becomes even more exciting because this book is written



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# Letters to the Editor

## Embarrassing all right

Tough luck! I found your mistake in the March 1969 issue of *Science Digest*. The inside front cover headline, "Another embarrassing egg," so attracted my attention that I noticed parts of very faint letters in between the other letters. Looking closer I saw that the letters spelled the same words—only with one difference; there was an "s" missing in embarrassing, so the bright blue was only a cover-up for the mistake. It would have been an embarrassing "egg" if the mistake had been left uncorrected.

Better luck next time to the cover-up department.

TRACEY TREMAN  
Muskegon, Mich.

*You are right. What sharp eyes you have.—Ed.*

## Protection or prevention?

Protection of the public health is a commendable goal; however, Miss O'Connell's article, "Quacks—the would-be MDs who can harm you," page 16, January 1969, constitutes a disservice in this respect.

Should Miss O'Connell wish to produce material of a sound nature concerning chiropractors and other practitioners operating outside the allopathic establishment, I suggest that



(1) total reliance on spokesmen for orthodoxy constitutes the very poorest (although admittedly the easiest) sort of research; (2) some knowledge of the "sociology of science" would be invaluable to anyone sincerely desiring to appraise in accurate fashion the reactions of any established body of the learned to its heterodox intruders; (3) sound research into the area into which Miss O'Connell unfortunately saw fit to venture would involve a considerable amount of time (a) studying a variety of recent material on unorthodox or "fringe" medicine, (b) investigating state licensing requirements for those lawfully authorized to practice a legally recognized healing art, and (c) adequate person-to-person contact with a variety of non-allopathic practitioners, as well as extensive discussions with faculty and students in the educational institutions belonging to non-allopathic groups.

WARREN D. SMERUD  
Professor of Philosophy  
Concordia College  
Moorhead, Minn.

*Not all persons consulted for this article were "spokesmen for orthodoxy," if by orthodoxy is meant the American Medical Association. Douglas Hansen (quoted) is with the U. S. Food and Drug Administration; John Miner, also quoted, is in the Los Angeles District Attorney's Office. James H. Young, Ph.D., a historian from Emory University, Richard Maxwell of the National Better Business Bureau and Ronald Deutsch, a science writer well informed on both sides of the controversy, supplied background material. Since these sources are neither physi-*

*cians nor AMA members, they cannot be regarded as reacting to "heterodox intruders" on their domain.—Ed.*

## Contribution to public good

Your article on medical quackery (January, 1969) is a well written contribution to educating the public about the dangers of this vicious fraud.

JOHN W. MINER  
Head, Medical-Legal  
Section  
Deputy District Attorney  
Los Angeles, Calif.

## Medical quackery propaganda?

You have either been had and published the article on medical quackery (January 1969) "canned," assuming it was the truth, or you are well aware of the criminal conspiracy conducted by the AMA.

But the truth will come out soon, and if your readers get the idea that *Science Digest* is not that at all, but a medium for crude AMA propaganda, you will have had it.

S. L. JAMISON, D.V.M.  
Turlock, Calif.

## Who are the quacks?

"Quacks—the would-be MDs who can harm you" (January 1969), put all those the AMA and FDA do not approve of in the same class with Spectro-Chrome therapy and "Colonel" Dinshah P. Ghadiali.

Go back to September, 1968, page 26, "At last: a powerful, safe painkiller," by Hans Fantel. We wonder why Talwin was let on the market

when such things as DMSO (page 7, same issue) are banned along with such as Hoxey, Koch, Krebiozen or Laetrile—all known to have cured cancer. My question is, "Who are the quacks?"

L. B. LEWIS  
Grand Junction, Colo.

Tony Saulnier and Hubert Herzog might have discovered something they weren't supposed to know about the statues and where they came from? Could it be that the plane crash that killed them wasn't an accident?

THOMAS PRINCKO  
Union Lake, Mich.

### Bad plate, not flying saucer

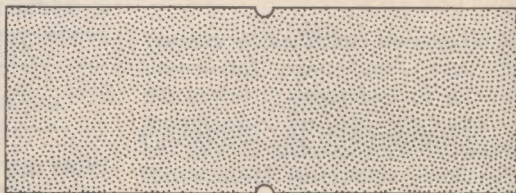
I was reading the Easter Island article in the August 1968 issue. I noticed in one of the photographs in the article what appears to me to be a flying saucer. I would like to know if this object also appears on the negatives. If it does, could it be that

*The white ellipsoid form which appears to be hovering in the photograph at the bottom of page 28 of the "Easter Island" article is not a flying saucer. It is merely a printing flaw in your copy and does not appear in any other copies of that issue kept at Science Digest's editorial offices.—Ed.*

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Pictorial Parade

## The nosey kind

**A**T A BUTTERFLY FARM in Bexley, England, a British schoolboy gets a close inspection from a tropi-

cal species of butterfly. The farm breeds species from all over the world, supplying them to schools.

ADVENTURES IN

# Science & Discovery

IN THIS ISSUE



**Drug addiction is not physiologic**  
A behind the scenes article by the former head of New York's Addiction Agency, Dr. Efren E. Ramirez, M.D. On page 20 he explains why he believes addiction is a disease of character, not body.



**A test tube Stone Age?**  
A Dane with a dream wanted to study the ancient past close up—so he recreated it, complete with village, tools and people, page 26.



**Puzzle paintings of old masters**  
Many of the great artists of the past turn out to be great humorists too. They took delight in concealing riddles and puzzles in the backgrounds of their paintings—not to mention an occasional semi-clad female in a voluptuous pose. All this to illustrate the science of perspective on page 12.